TEST EQUIPMENT OF THE E O L E SATELLITE

BALLOON SIMULATOR

BALLOON SATELLITE CONNECTION

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DIFFUSION

X. NAMY
M. TROUBLE
J. P. GUINARD
J. LADOUX
D. DEBERNARD
V. CASTAN
D. BALLATON
B. FABIANA 2 ex.
M. PISSARD
J. P. JOLI
J. BARCELERE 2 ex.

BALLOON SIMULATOR

GENERALITIES

BALLOON SIMULATOR

1. Generalities
2. Arrangement
3. Schemas
4. Implantations

1. Generalities

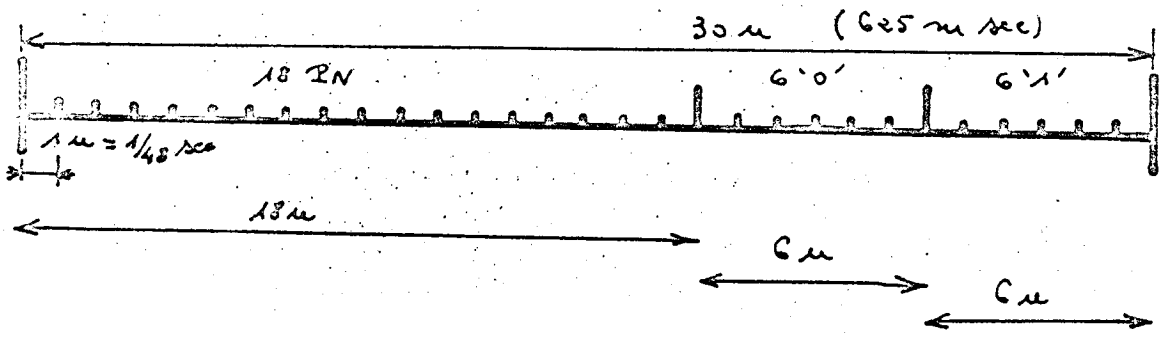
1.1 Object

The balloon simulator has as its goal reconstructing, in the course of the satellite's integration, one of the experimental balloons. The simulator can be considered on the one hand as a generator of the parameters of balloon-satellite connection and on the other hand as a receiver of the balloon call message.

1.2 Recall of the connection characteristics SAT-BL and BL-SAT

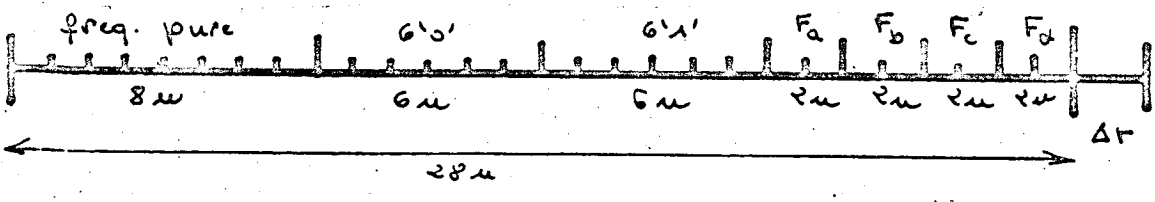
12.1 Connection SAT-BL (464, 4864 MHz)

The balloon call message issued from the satellite presents itself as indicated below.

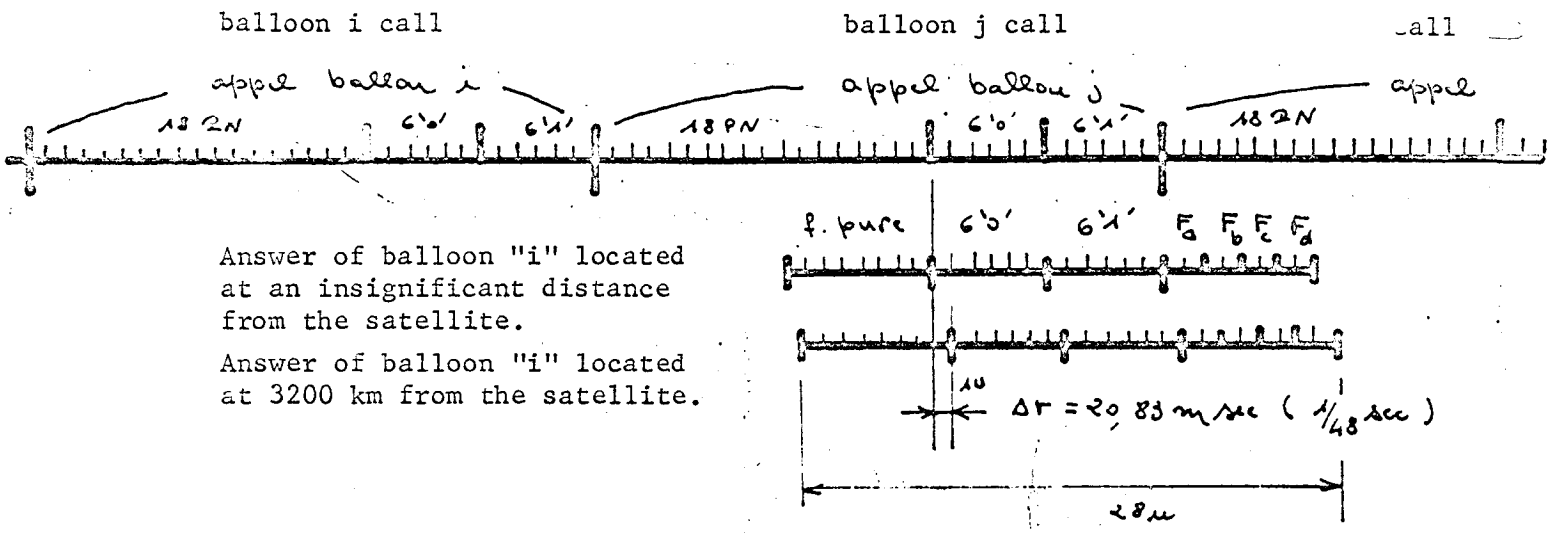


122 Connection BL-SAT (401, 717960 MHz)

The message issued from the balloon has as its characteristics



12-3 Adjustment of the BL thrust in relation to the BL call message



Answer of balloon "i" located at an insignificant distance from the satellite.

Answer of balloon "i" located at 3200 km from the satellite.

12.4 Remarks

Two supplementary parameters, due to the respective speed and positions of the satellite and of the balloon, intervene in the connection.

1) The Doppler effect

2) Distance

12.5 Decommutation simulation

Simulation

All the parameters which interfer in the BL-SAT connection are to be simulated: the distance, the Doppler, the 4 HK BL frequencies (Fa, Fb, Fc, Fd).

Decommutation

The characteristic parameters of the BL call message are to be decommutated: 18 PN, the 6'0', 6'1'.

2. Arrangement of the simulator

2.1 BL-SAT connection

This connection which concerns the BL answer will be realized in simulating the information contained in the balloon answer (video) on one hand and the parameters concerning the geometry of the system on the other hand (Doppler, distance).

Three slides associated with a synthetizer (which plays a role of balloon transmitter) assure the simulation.

The heart of the system is the slide called "adaptation" which on the one hand has the role of acquisition of the data of the simulation and on the other hand a role of mixer of the information making up the balloon answer. Two slides are associated -- on the one hand the "distance" slide which permits the simulation of the distance and the generation of a command signal slides: on the other hand the "veo" slide furnishes the HK balloon frequencies.

The "Doppler" simulation is realized in the slide adaptation. A programable attenuator commanded by the distance simulation command bits permits obtaining the simulation of the level of connection.

2.2 Remarks

In its actual conception the simulator of balloon answer permits two types of function: either manually or automatically. In the two cases each simulation can be commanded by three bits (2^3 stages).

a) Manual functioning

This type of functioning permits beginning with a control panel, located directly in front of the simulator, commanding the six simulations: charge of the simulation register.

b) Automatic functioning

This type of function is obtained beginning with a PB 250 calculator for the set of PTU and WOE instructions.

The PTU (34 in the case of the simulator) simulation opening and permits the transfer of the information contained in the WOE which follows (transfer of the calculator to the opening: charge of the register of the simulated material).

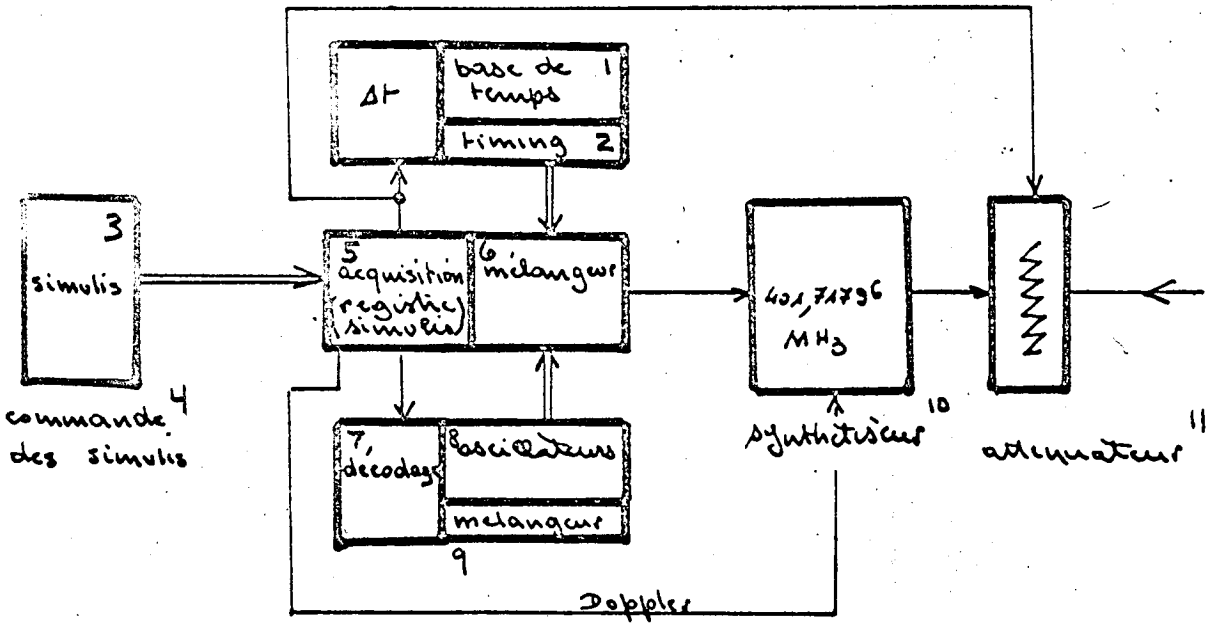
2.3 SAT-BL connection

It concerns decommuting the call message issued from the satellite.

The essential element of the system is the decommutation assembly which is associated on the one hand with the reception assembly (receiver bit synchro) and on the other hand with a visualization.

3. Schemas

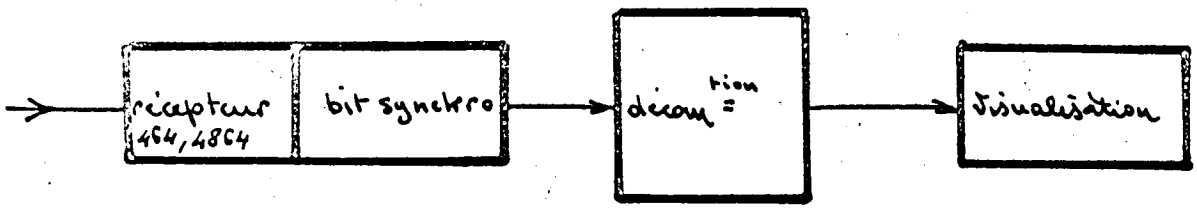
3.1 BL-SAT connection



Key:

1. Time base
2. Timing
3. Simulation material
4. Command of the simulated material
5. Acquisition (simulated material registered)
6. Mixer
7. Decoding
8. Oscillators
9. Mixer
10. Synthetizer
11. Attenuator

3.2 SAT-BL connection

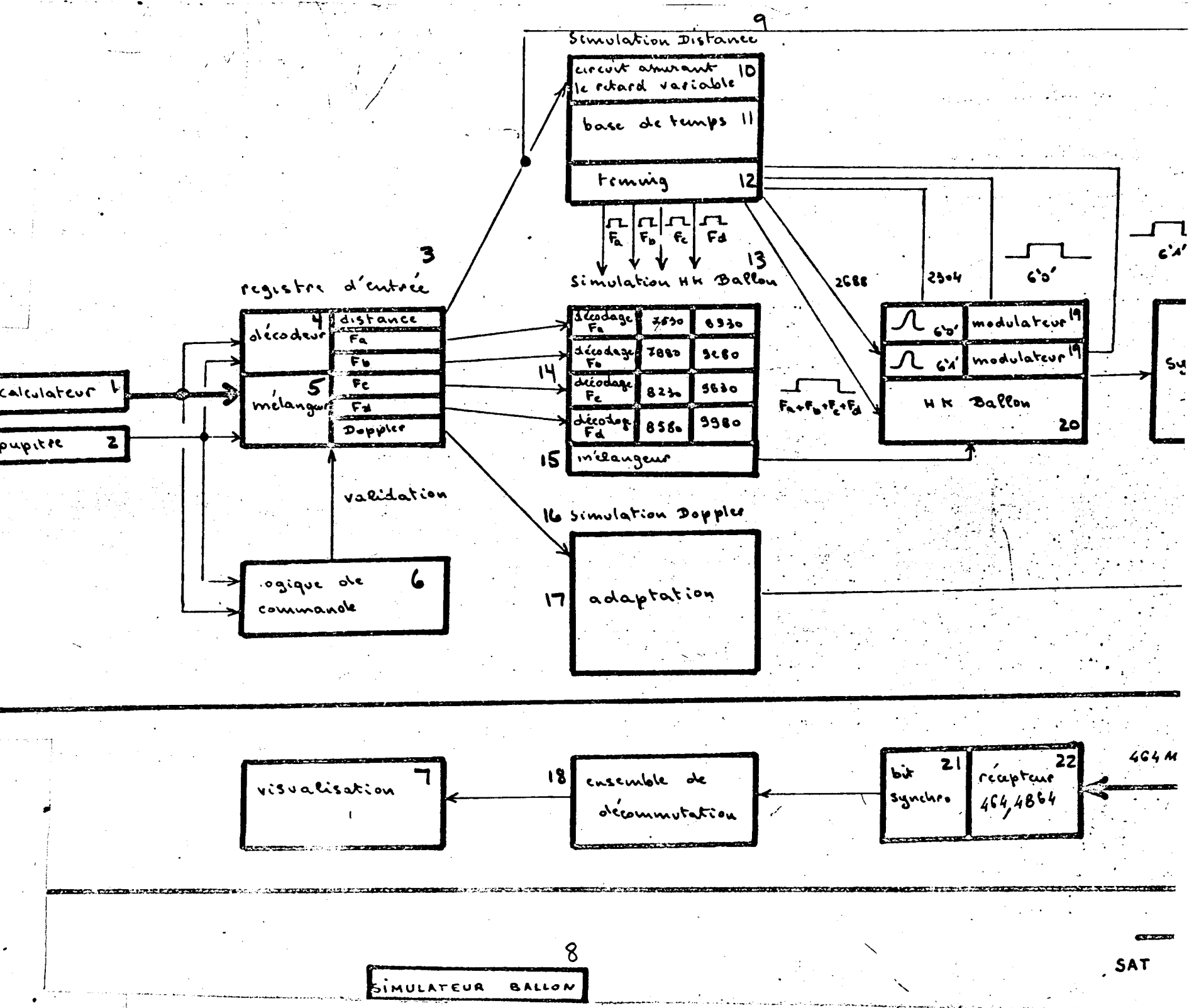


Receiver Bit synchro Decommutation Visualization

Key for figure page 7

3.3 General schema

1. Calculator
2. Control panel
3. Entry register
4. Decoder
5. Mixer
6. Command logic
7. Visualization
8. Balloon simulator
9. Distance simulation
10. Circuit assuring variable delay
11. Time base
12. Timing
13. HK balloon simulation
14. Decoding
15. Mixer
16. Doppler simulation
17. Adaptation
18. Decommutation assembly
19. Modulator
20. HK balloon
21. Bit synchro
22. Receiver
23. Synthetizer
24. Interface


9
Simulation Distance
circuit assurant le retard variable 10
base de temps 11
temmig 12
Fa Fb Fc Fd
3
registre d'entrée
4
décodeur
distance
Fa
Fb
Fc
Fd
Doppler
5
mélangeur
calculateur 1
pupitre 2
validation
logique de commande 6
13
Simulation HK Ballon
décodage Fa 7530 8930
décodage Fb 7880 9c80
14
décodage Fc 8230 9830
décodage Fd 8580 9980
15
mélangeur
16 Simulation Doppler
17
adaptation
2688
2904
6'0'
6'1'
modulateur 19
modulateur 19
HK Ballon 20
Fa+Fb+Fc+Fd
visualisation 7
18
ensemble de décommutation
bit synchro 21
récepteur 464,4864 22
464 M
8
SIMULATEUR BALLON
SAT

4. Implantations

4.1 Balloon connection simulator BL-SAT

Oscilloscope

Slide adaptation

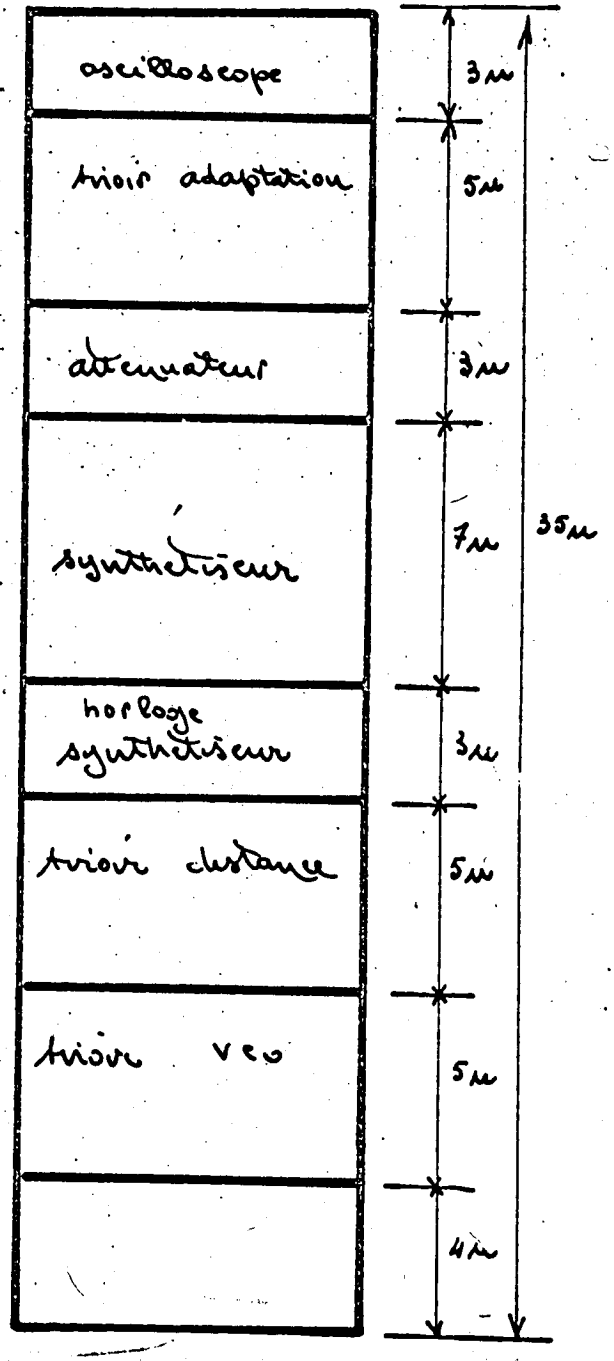
Attenuator

Synthetizer

Timing synthetizer

Distance slide

VEO slide



AUTOMATIC FUNCTIONING

(Beginning with PB 250)

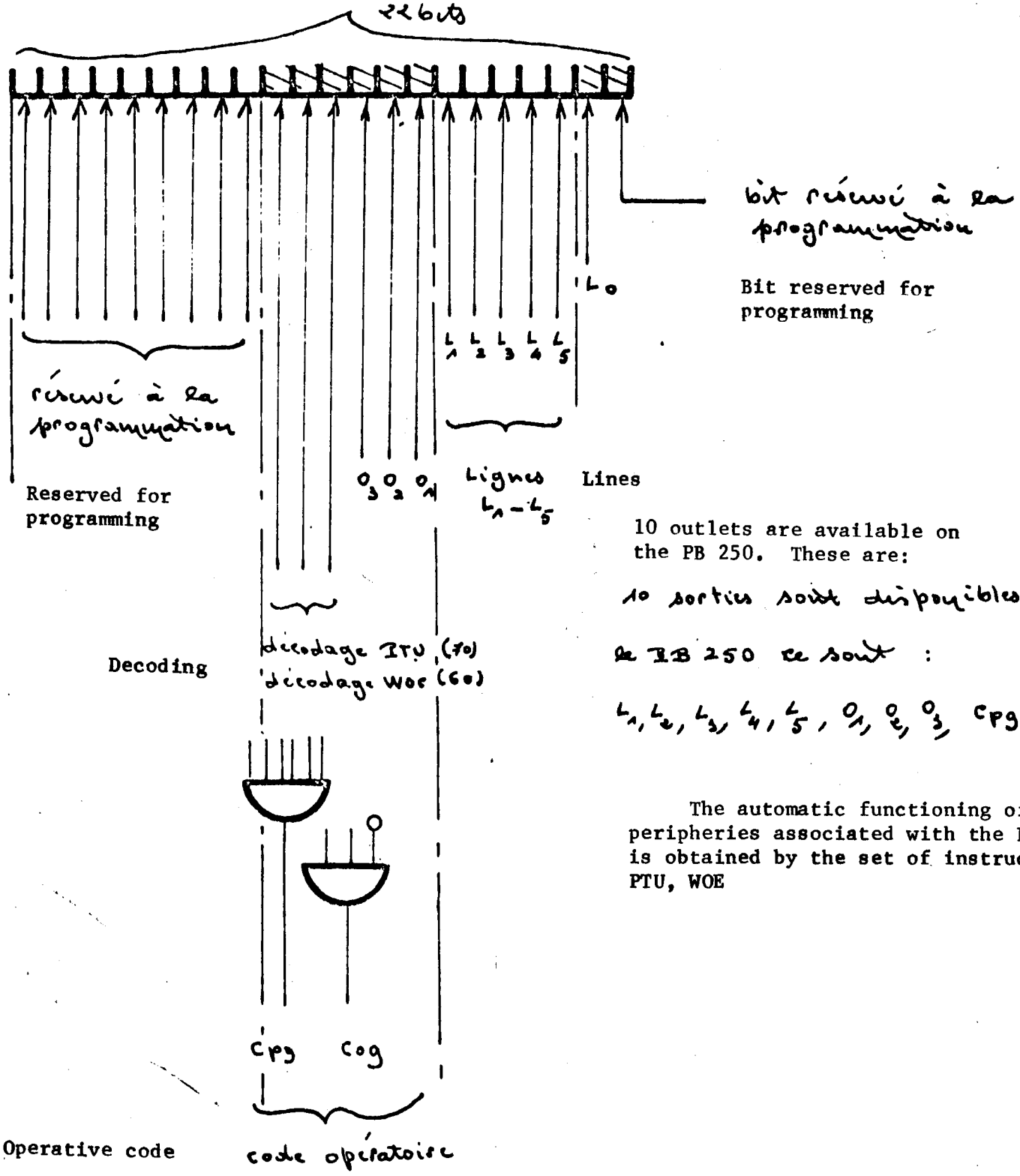
Automatic functioning beginning with calculator PB 250

1. Recall
2. Definition and role of the PTU-WOE instructions
3. Utilization of these two instructions
4. Functioning in passive mode
5. Functioning in active mode

Automatic Functioning

1. Recalled

The automatic functioning of the periphery associated with the PB 250 calculator is assured beginning with the instruction register whose characteristics are the following:



10 outlets are available on the PB 250. These are:

10 sorties sont disponibles sur le PB 250 ce sont :

$L_1, L_2, L_3, L_4, L_5, O_1, O_2, O_3$, Cpg, Cog

The automatic functioning of the peripheries associated with the PB 250 is obtained by the set of instructions PTU, WOE

2. Definition and role of the instructions PTU and WOE

2.1 PTU

The PTU is an instruction which is present simultaneously on the lines L_1, L_2, L_3, L_4, L_5 and Cpg.

This instruction permits validating the transfer, toward a peripheral organ, of the information contained in the WOE which immediately follows it.

The lines L_1, L_2, L_3, L_4, L_5 are bearers of a code intended to validate the entry organ of such and such a periphery. (Each periphery having its code.)

The line Cpg is the bearer of a signal indicating that one has a PTU.

2.2 WOE

The WOE is an instruction which is present simultaneously on the lines L_1, L_2, L_3, L_4, L_5, O_1, O_2, O_3.

The lines L_1, L_2, L_3, L_4, L_5, O_1, O_2, O_3 are bearers of the information which one wishes to transfer from the calculator to the peripheral organ selected by the PTU (which has preceded the WOE) (8 bits).

The line Cog is the bearer of a signal indicating that one has a WOE.

Duration of these instructions.

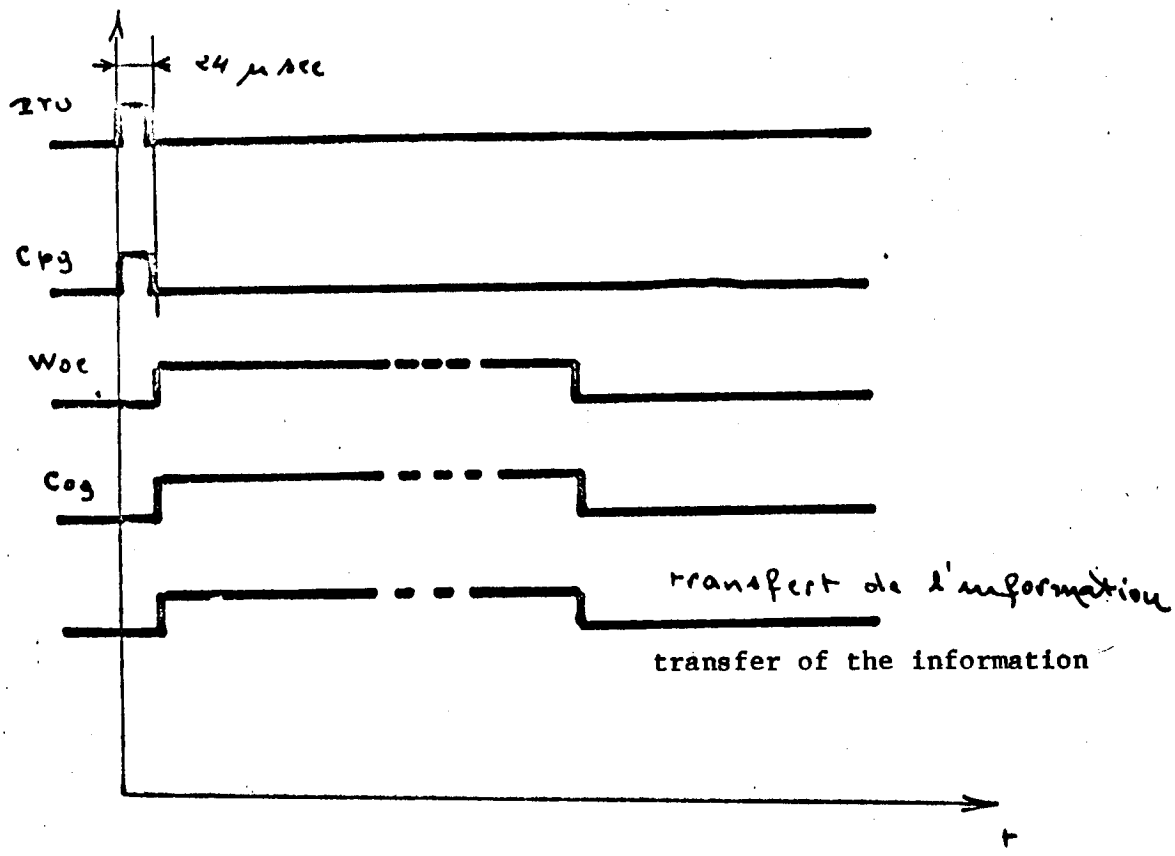
The PTU lasts 24 μ sec.

The WOE, which immediately follows the PTU, lasts the time necessary for the peripheral organ to take into account the information which the calculator transmits to it.

3. Utilization of these two instructions

In order to transmit the information from the PB 250 toward a peripheral organ we have seen that we should have the two instructions PTU-WOE.

The following diagram shows the mechanism of transfer of the information.



4. Functioning (passive mode)

The automatic operation of the system is obtained by relying on a command instrument desk of the PB 250.

The peripheral organ being a receiver in this type of functioning when the calculator receives the order of operation; for program, the information crosses to the peripheral organ.

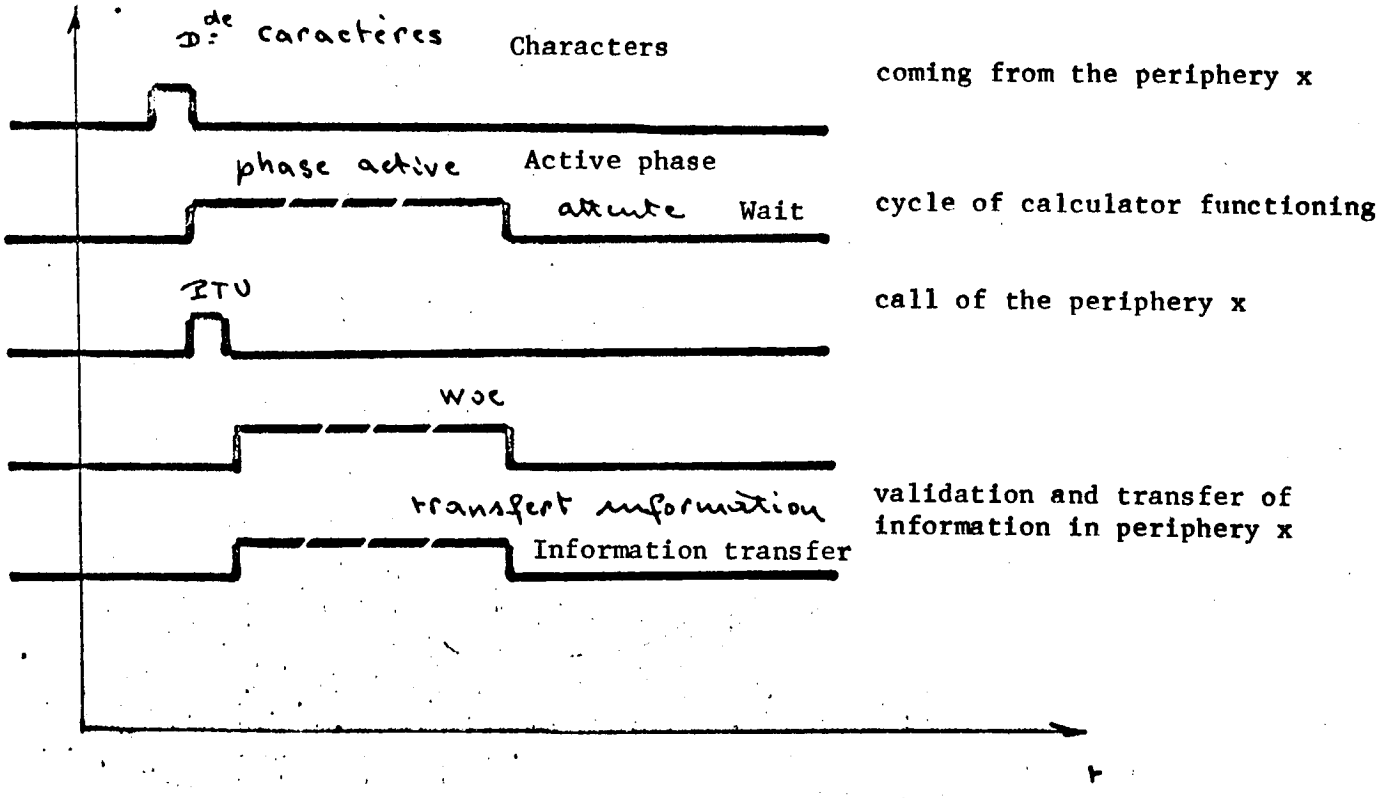
Remarks

Another type of automatic function exists where (line lost at bottom of page 4) The periphery transmits to the calculator in order of characters.

5. Functioning in the active mode

The calculator is in wait for an order of characters (it turns on a test). When the order of characters comes to it, it (text unreadable) its program and transmits again, by the set of instructions PTU-WOE, the information to the periphery which has just sent it an order of characters.

Diagram



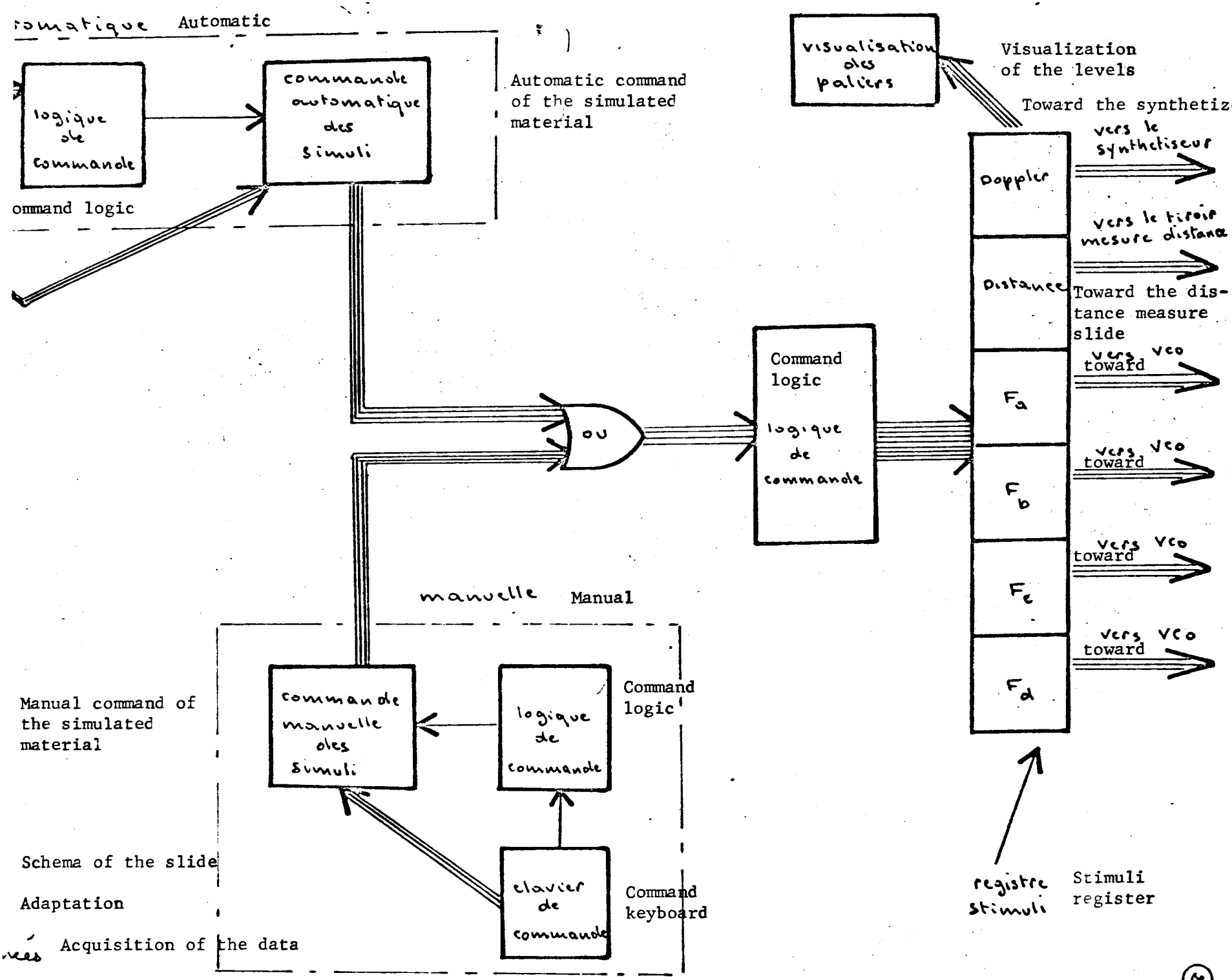
Remarks

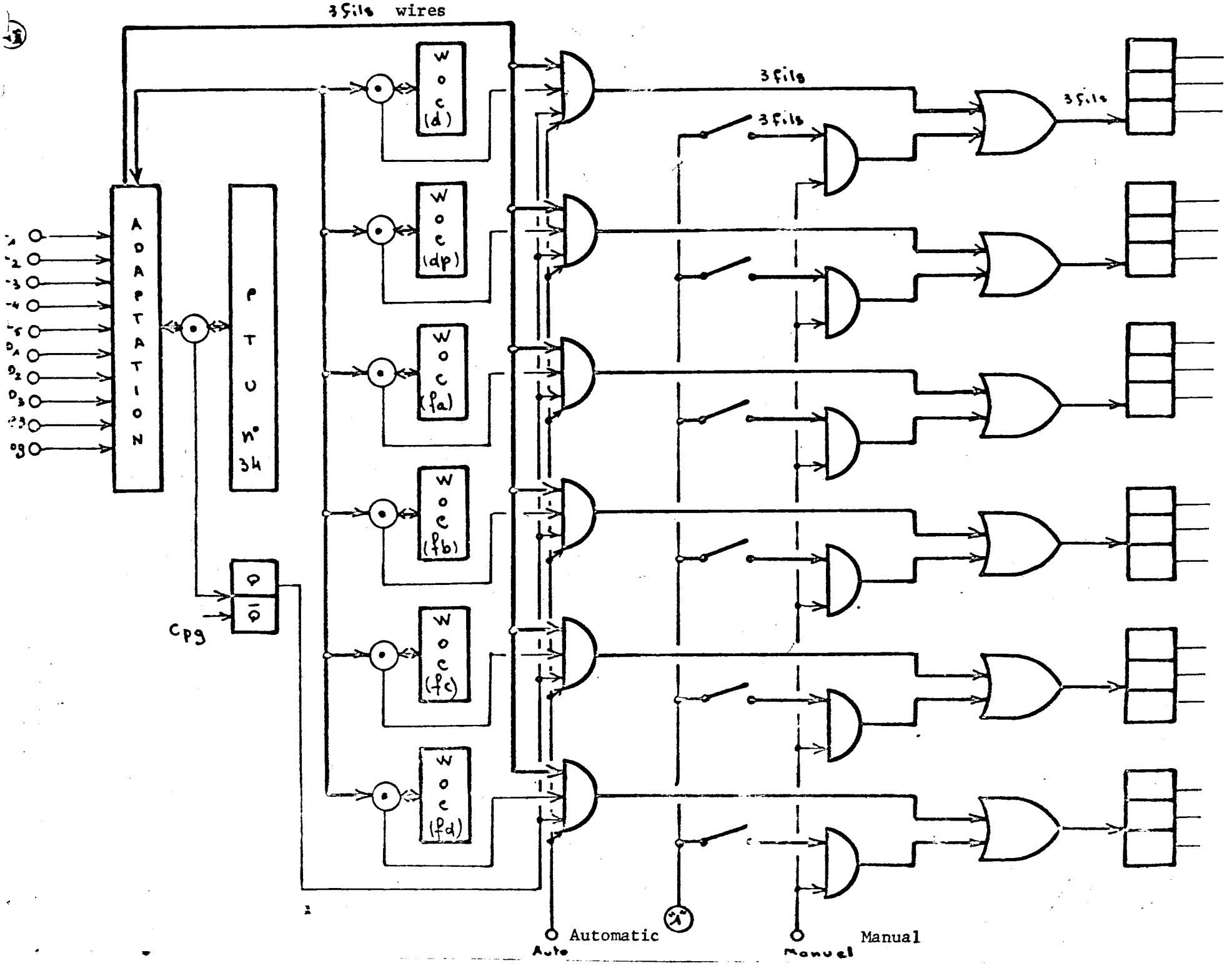
Two other orders of character which one can unwind a program containing several PTU-WOE tests if necessary.

ADAPTATION SLIDE

Adaptation Slide

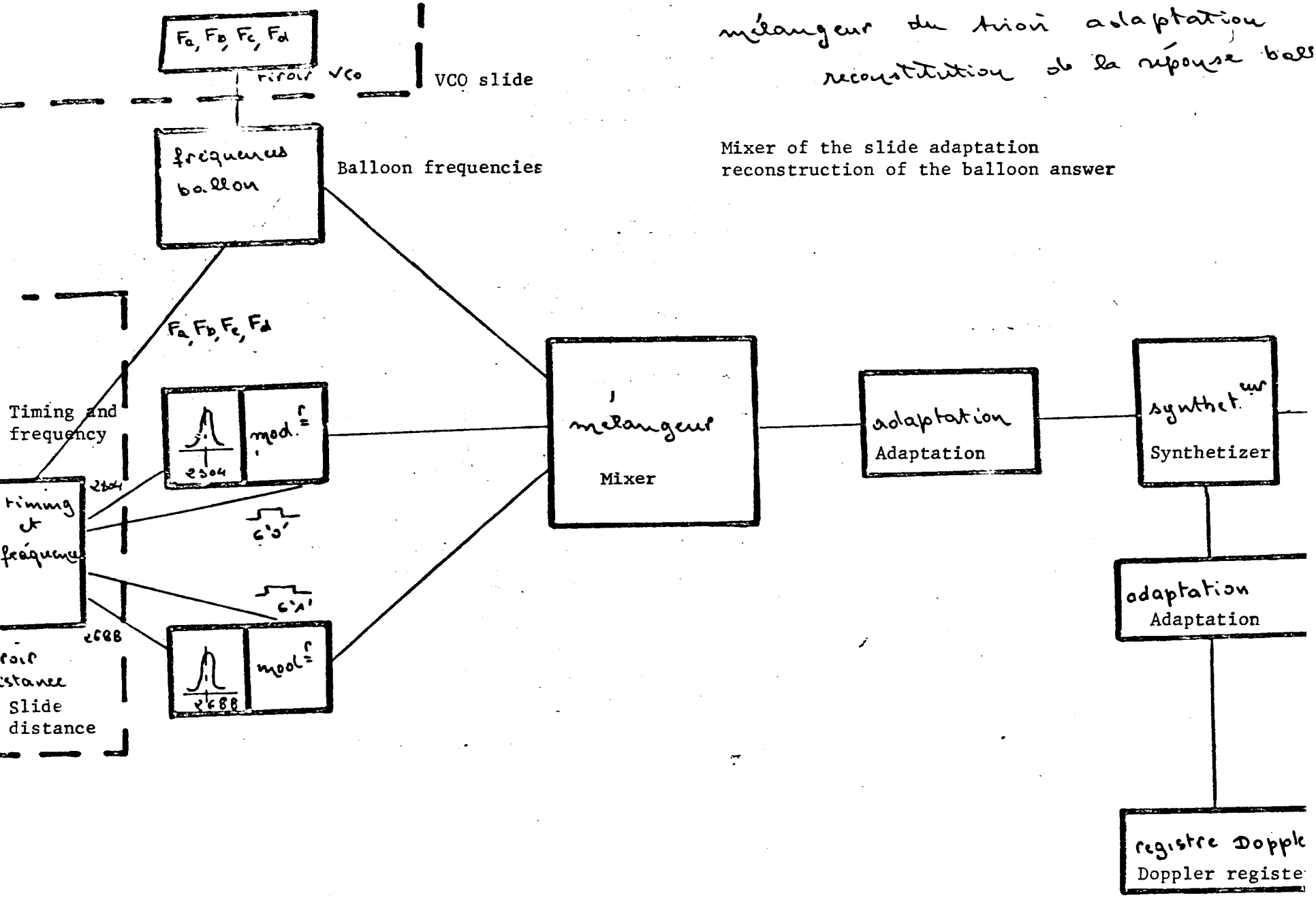
1. Generalities
2. Automatic command of the simulations
3. Manual command of the simulations
4. Charge of the plug and visualization register
5. Sending of the balloon answer


omatique Automatic
logique de commande
ommand logic
commande automatique des simuli
Automatic command of the simulated material
visualisation des paliers
Visualization of the levels
Toward the synthetizer
vers le synthetiseur
Doppler
vers le tiroir mesure distance
Distance
Toward the distance measure slide
Command logic
logique de commande
ou
vers vco toward
F_a
vers vco toward
F_b
vers vco toward
F_c
vers vco toward
F_d
manuelle Manual
Manual command of the simulated material
commande manuelle des simuli
logique de commande
Command logic
Schema of the slide
Adaptation
Acquisition of the data
clavier de commande
Command keyboard
registre stimuli
Stimuli register


3 fils wires
ADAPTATION
PTU N° 34
D
D̄
Cpg
woc (d)
woc (dp)
woc (fa)
woc (fb)
woc (fc)
woc (fd)
3 fils
3 fils
3 fils
Automatic
Manual
Auto
Manual

mélangeur du trion adaptation
reconstitution de la réponse ball

Mixer of the slide adaptation
reconstruction of the balloon answer



1. Generalities

1.1 Object of the adaptation slide

The answer of the balloon being simulated beginning with a synthetizer of frequency modulated in phase by the frequencies corresponding to the distance and to the information of balloons which must be commanded.

a) The frequency of the synthetizer (eight stages or 3 bits) permitting the making of: "the Doppler measure."

b) The dephasing of a time base (8 levels or 3 bits) in order to make: "the distance measure."

c) The four frequencies of balloon information (8 levels or 3 bits on each frequency).

The goal of the adaptation slide is to permit the command both automatic and manual, numerous stimuli and to assure the visualization of the different levels of variation of Doppler and distance and the 4 HK balloon frequencies.

1.2 Constitution of the slide

One distinguishes three quite distinct ranges.

a) The automatic command.

b) The manual command.

c) The transfer of the stimuli to a plug register.

1.2.1 Automatic command

Numerous functions are found there such as

1. Bay adaptation calculator.
2. PTU decommutation.
3. WOE decommutation.
4. Transfer logic.

1.2.2 Manual command

This level is constructed as follows

1. Keyboard for sending different levels.

2. Command signal.

1.2.3 Transfer of the stimuli

This level is common to the two types of commands; one finds there

1. An "ou" function.

(#2 is not on the bottom of page 4 or the top of page 5)

3. The visualization of the level.

12 - 3 Sending of the balloon answer

2. Automatic command of the simulations

2.1 Generalities

The order of validation of the "balloon simulation" slide will be a PTU (34) order of a duration of 24 us followed by a WOE instruction of six m sec.

One distinguishes six types of signals determined as is indicated below:

	0_3	0_2	0_1	1_5	1_4	1_3	1_2	1_1
Doppler	0	0	1	0	0	X	X	X
Distance	0	1	0	0	0	X	X	X
F_a	0	1	1	0	0	X	X	X
F_b	1	0	0	0	0	X	X	X
F_c	1	0	1	0	0	X	X	X
F_d	1	1	0	0	0	X	X	X

The positions $\perp_1$, $\perp_2$, $\perp_3$ are reserved in order to transmit the value of the level.

2.2 Adaptation

2.2.1 Principle

The goal of this first circuit is to adapt the levels. In effect the calculator logic is such that one has

"1" -10^V

"0" 0^V

On the other hand in the bay the levels are

"1" $+2,5^V$

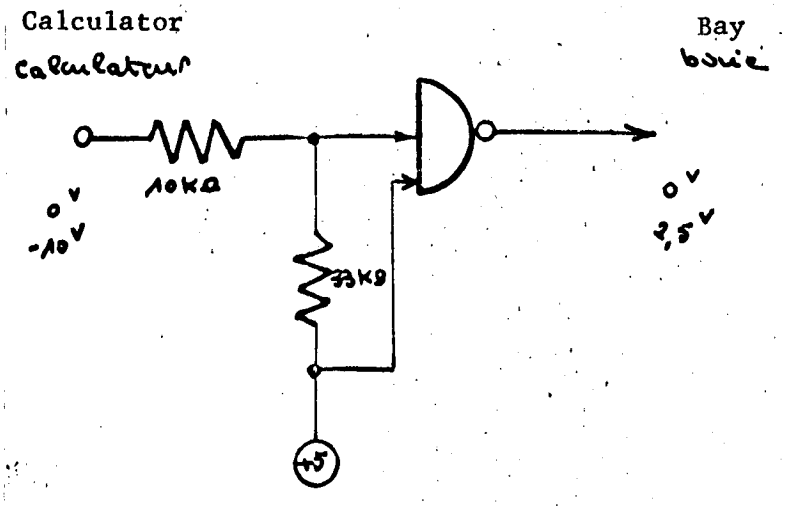
"0" 0^V

A circuit should therefore assure the expression of the (word unreadable) while keeping the correspondence of the levels.

The circuit retained is of the resistance bridge type (one extremity of the $+5^V$ the other joined to the coax of the calculator output) attacking a "yayd" door whose outlet assures the connection (line lost at bottom of page 5)

2.2.2 Schema

The mounting retained is thus the following



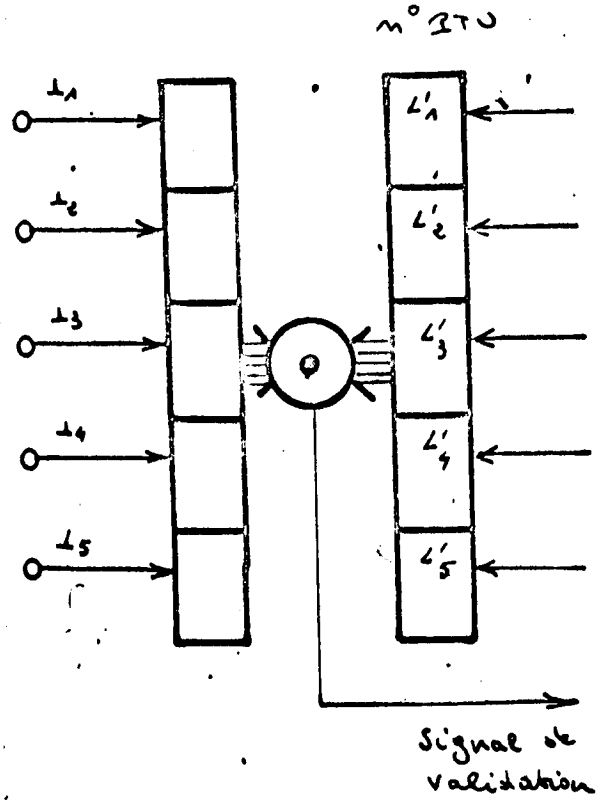
This mounting is applied on the ten output wires of the calculator

$L_1, L_2, L_3, L_4, L_5, O_1, O_2, O_3, C_{pg}, C_{og}$.

2.3 PTU Decommutation

2.3.1 Principle

On the five wires L_1, L_2, L_3, L_4, L_5 is found the PTU information. A coincidence between these five wires and the condition of a register permits disposing of a signal which validates the slide.

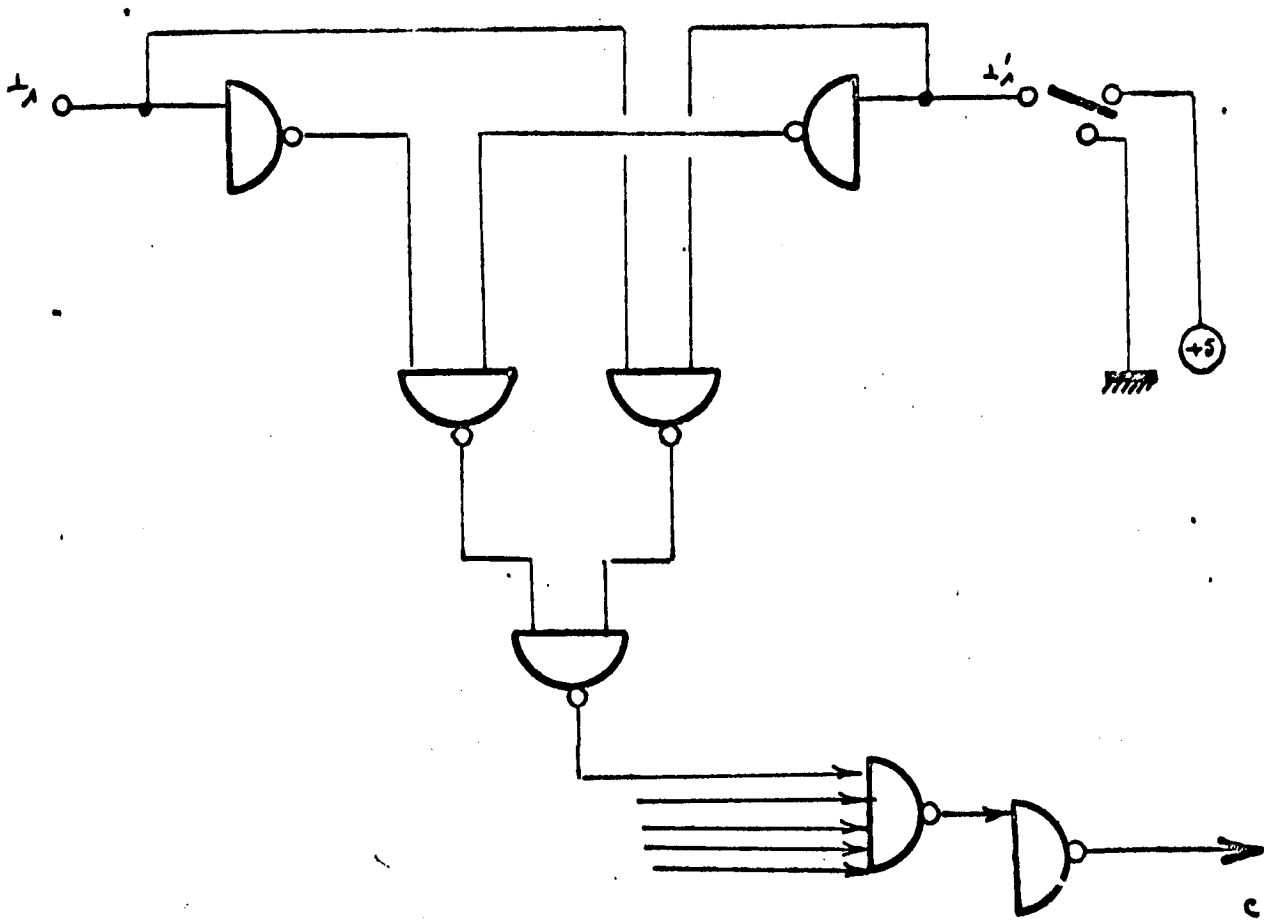


Validation signal

The coincidence is accomplished wire to wire between the output lines of the calculator after adaptation to the condition of five wires corresponding to a binary combination indicating the number of PTU (34).

2.3.2 Realization

The circuit considered permits precabling easily on a printed circuit curve the number of the PTU.



$$C = (L_1 L'_1 + \bar{L}_1 \bar{L}'_1)(L_2 L'_2 + \bar{L}_2 \bar{L}'_2)(L_3 L'_3 + \bar{L}_3 \bar{L}'_3)(L_4 L'_4 + \bar{L}_4 \bar{L}'_4)(L_5 L'_5 + \bar{L}_5 \bar{L}'_5)$$

2.4 Decommutation of the WOE

2.4.1 Generalities

We have seen that on the wires 0_1, 0_2, 0_3 could be six possible combinations corresponding to the Doppler, to the Distance, and to the four frequencies F_a, F_b, F_c, F_d.

The information being on the wires $\perp_1$, $\perp_2$, $\perp_3$ it concerns validating the transfer of six different informations in six registers of three bistables. The decommutation of the WOE assures this function of switching.

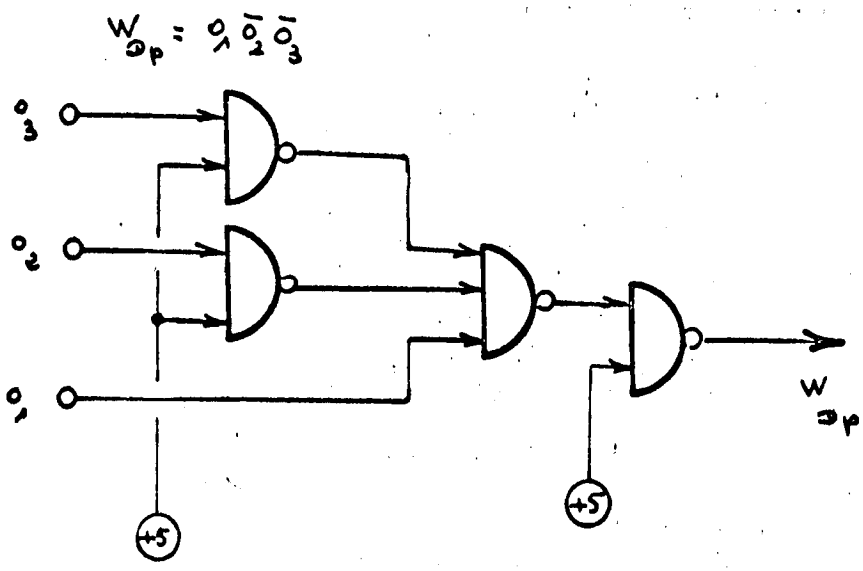
2.4.2 Principle of realization

One assures the decoding of the conditions in a round opening with the three entrances.

2.4.2.1 WOE Doppler (W_{dp})

One has the configuration 0_1 0_2 0_3

The circuit considered is the following. Its outlet equation is

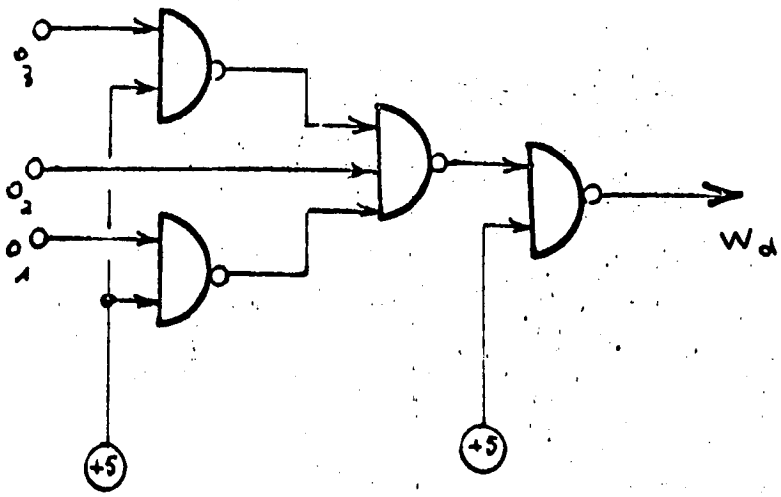


2.4.2.2 WOE distance (W_d)

One has a configuration

0_1	0_2	0_3
0	1	0

Therefore $W_d = \bar{0}_1 \; 0_2 \; \bar{0}_3$

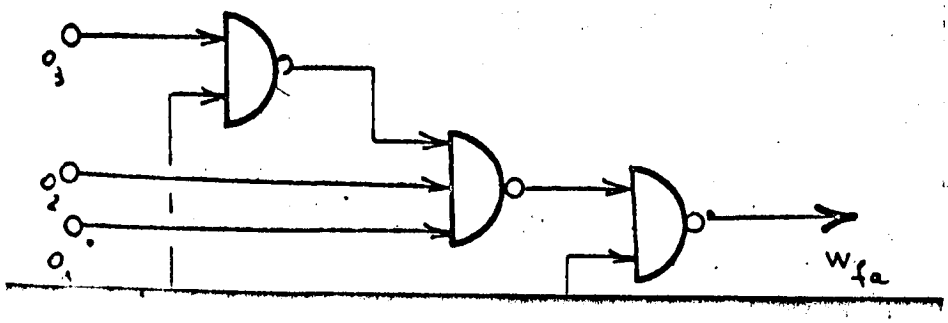


2.4.2.3 WOE frequency F_a (W_{fa})

One has a configuration

0_1	0_2	0_3
1	1	0

Therefore $W_{fa} = 0_1 0_2 \bar{0}_3$

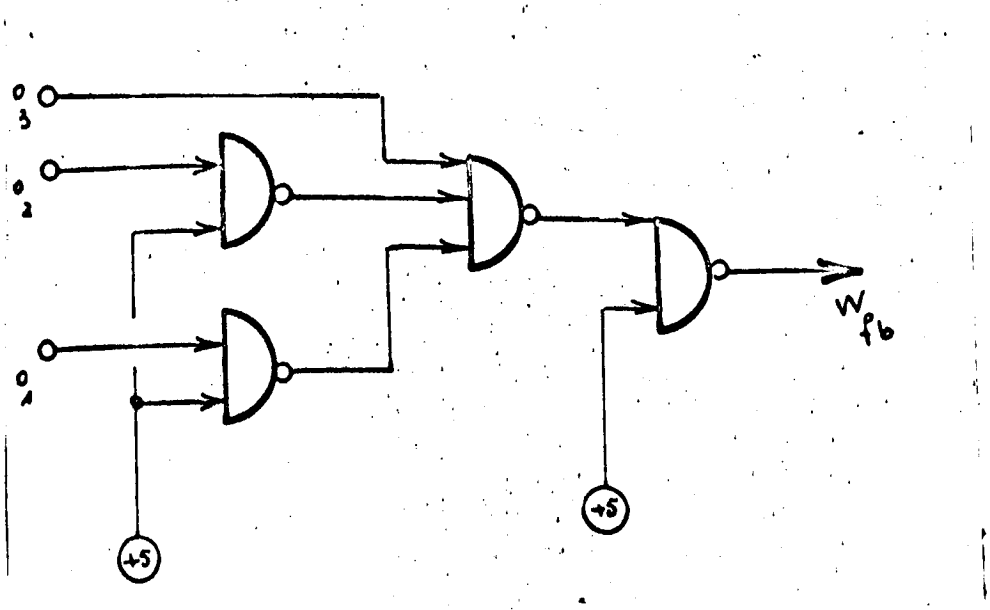


2.4.2.4 WOE frequency F_b (W_{fb})

On the wires $0_1 0_2 0_3$ one has the combination

0_1	0_2	0_3
0	0	1

Therefore $W_{fb} = \bar{0}_1\ \bar{0}_2\ 0_3$

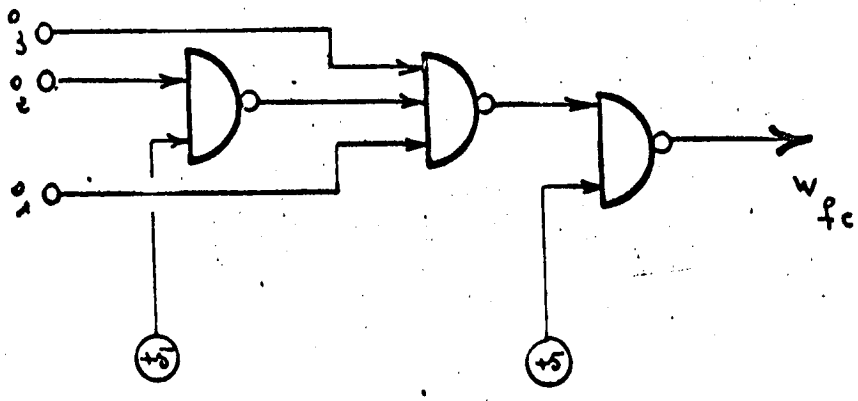


2.4.2.5 WOE frequency F_c (W_{fc})

One has the combination

0_1	0_2	0_3
1	0	1

Therefore $W_{fc} = 0_1 \bar{0}_2 0_3$

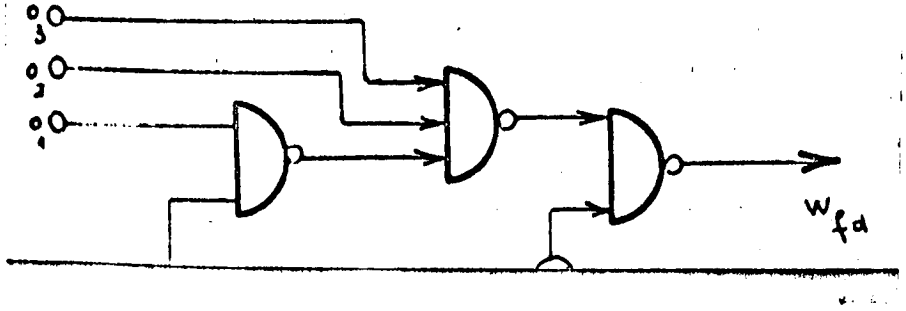


2.4.2.6 WOE frequency F_d (W_{fd})

On the outlet wires of the calculator one finds 0_1 0_2 0_3

0 1 1

Thus $W_{fd} = \overline{0}_1\ 0_2\ 0_3$

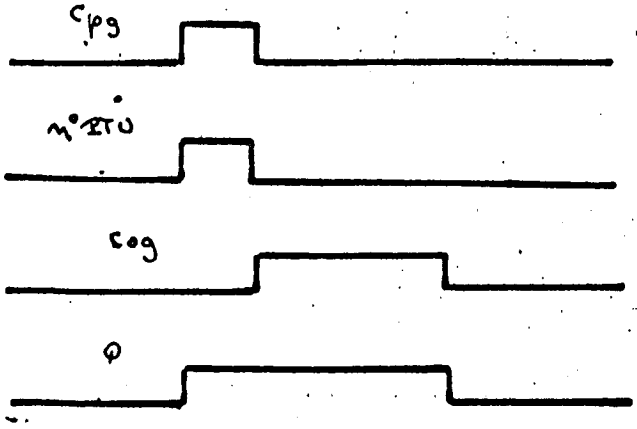


2.5 Utilization of the BTU and WOE signals

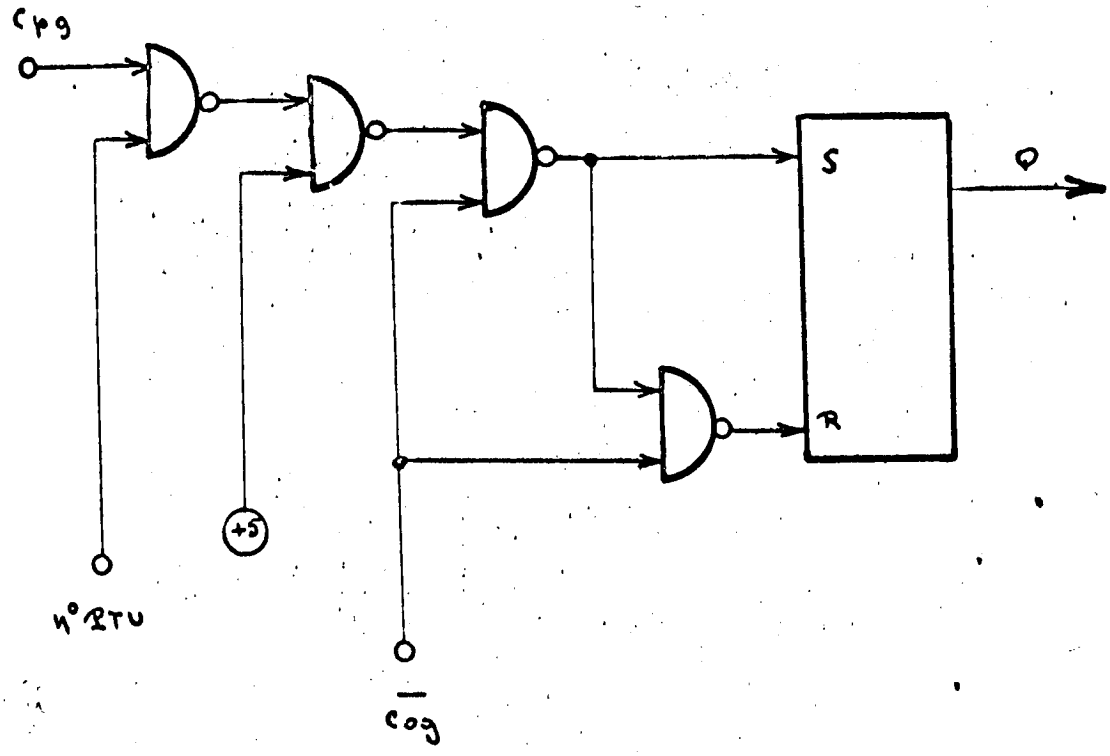
2.5.1 PTU

The PTU being recognized one disposes of a singal $\dot{e} = 1$ which positions a bistable at "1" for the duration of the WOE.

2.5.1.1 Diagram of functioning

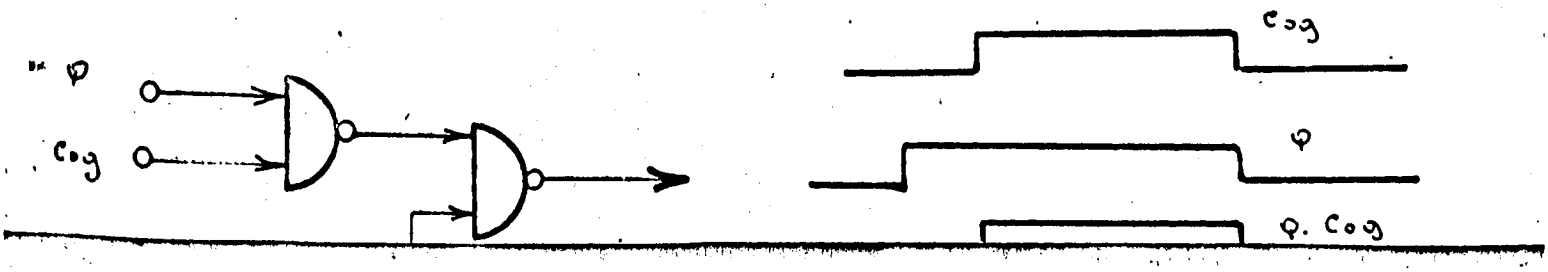


2.5.1.2 Schema

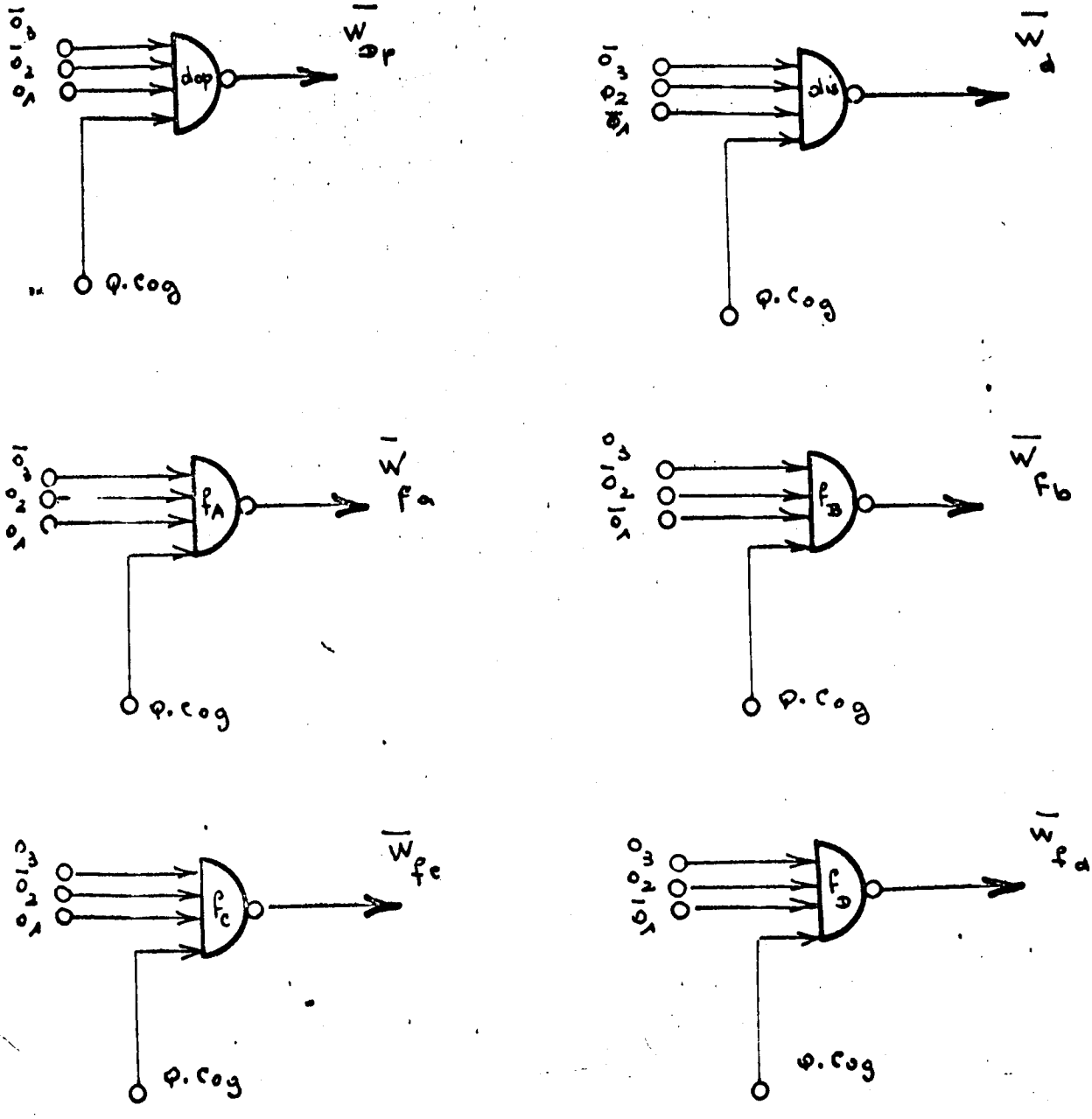


2.5.1.3 Remarks

One wishes that the bistable be at one only for the duration of the WOE. One realizes that the function Q. Cog



The signal Q. Cog serves to validate the decoding of the stimuli. Thus, one returns to the opening the decoding conditions and this signal. One has therefore the schemas, of decoding, following:



2.5.2 WOE

The decommutated WOE serves to validate the transfer of the information contained on lines L_1 L_2 L_3 seen on the plug register.

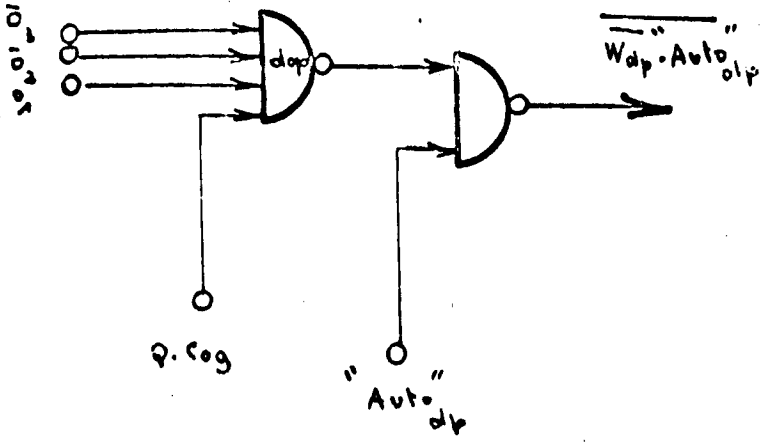
The switching WOE (0_1, 0_2, 0_3) should be on the other hand validated by the small automatic command button; thus one will have validation signals of information transfer of the form

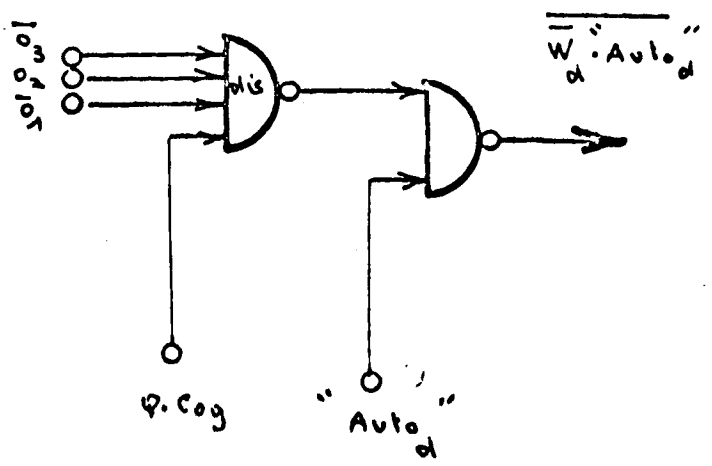
$\overline{W_{3p}}$: "Auto" $_{3p}$, $\overline{W_{d}}$: "Auto" $_{d}$, $\overline{W_{fa}}$: "Auto" $_{fa}$, $\overline{W_{fb}}$: "Auto" $_{fb}$, $\overline{W_{fc}}$: "Auto" $_{fc}$, $\overline{W_{fd}}$: "Auto" $_{fd}$

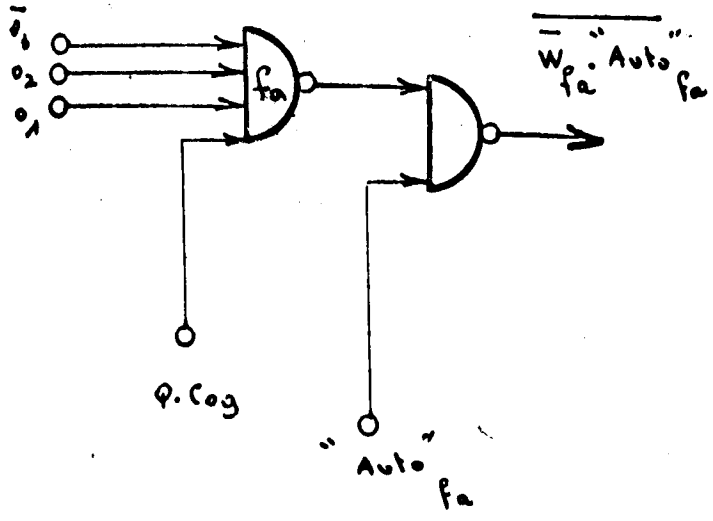
"Autoi." = "1" automatically.

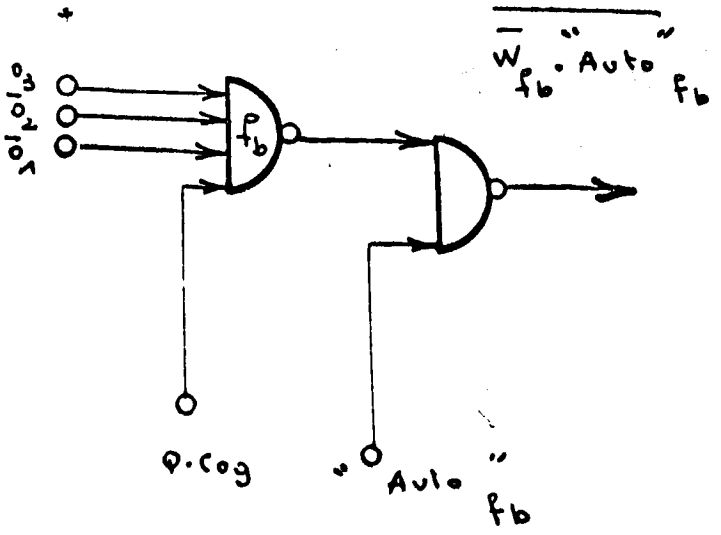
(words lost at bottom of page 11)

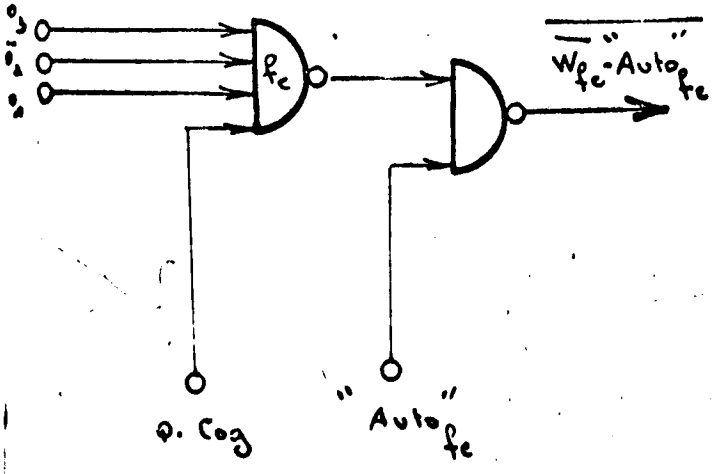
The command circuit schemas are the following

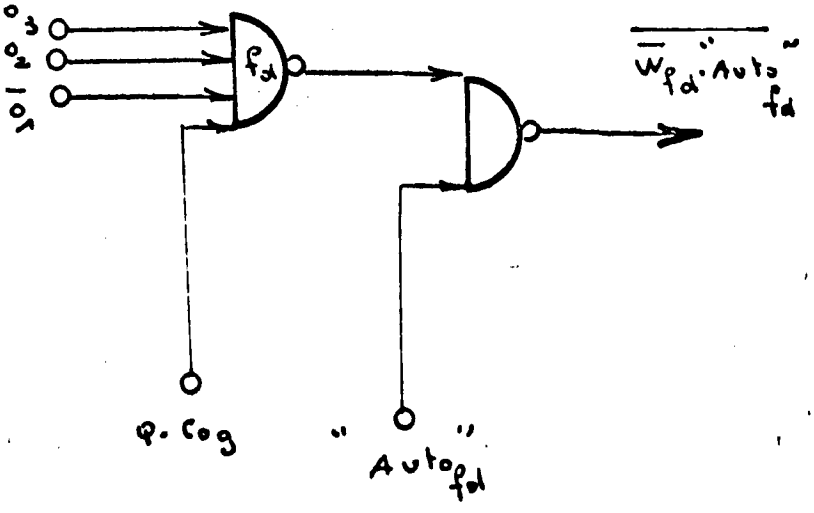












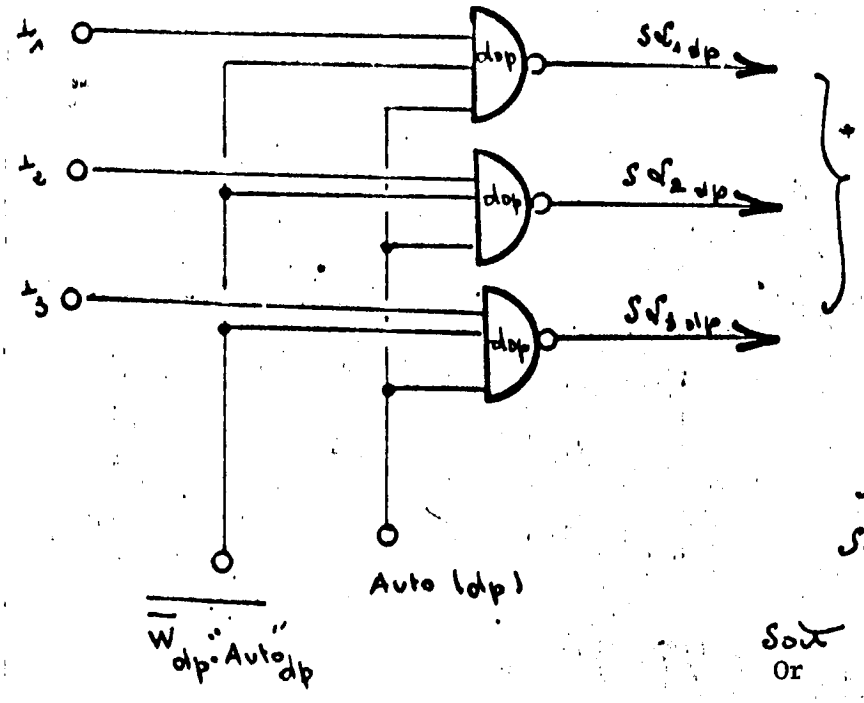
2.6 Information transfer

2.6.1 Generalities

The information is prescribed on lines l_1, l_2, l_3. This information can be switched in six different directions according to the condition of lines 0_1, 0_2, 0_3.

2.6.2 Schema

For the six possible directions the schema is the same. Here only is represented the command of the Doppler simulation.



Toward the charge circuit of the plug register.

$$S\mathcal{C}_{1\,dp} = l_1 \cdot \overline{\overline{W_{dp}} \cdot \text{"Auto"}_{dp}} \cdot \text{Auto}_{dp}$$

$$S\mathcal{C}_{2\,dp} = l_2 \cdot \overline{\overline{W_{dp}} \cdot \text{"Auto"}_{dp}} \cdot \text{Auto}_{dp}$$

$$S\mathcal{C}_{3\,dp} = l_3 \cdot \overline{\overline{W_{dp}} \cdot \text{"Auto"}_{dp}} \cdot \text{Auto}_{dp}$$

Soit Or

$$S\mathcal{C}_{ji} = l_j \cdot \overline{\overline{W_i} \cdot \text{"Auto"}_i} \cdot \text{Auto}_i \quad (j=1,2,3)$$

avec With $i = (Dop, Dist, F_a, F_b, F_c, F_d)$

3. Manual command

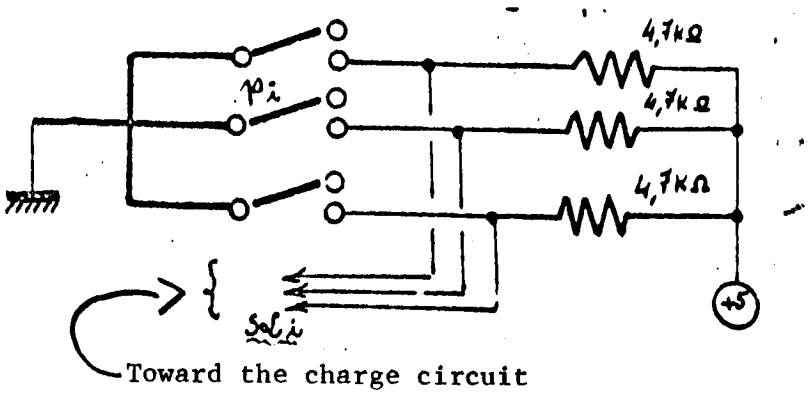
3.1 Generalities

The manual command has as its goal beginning with a keyboard accomplishing the sending of the simulations.

Three interrupters will be necessary for each simulation, in "on" position one will transmit the (word unreadable), in "off" position one will transmit level "1".

3.2 Schema

The 18 buttons are grouped by threes as is indicated



This circuit is the same for the six simulations.

Toward the charge circuit of the plug register.

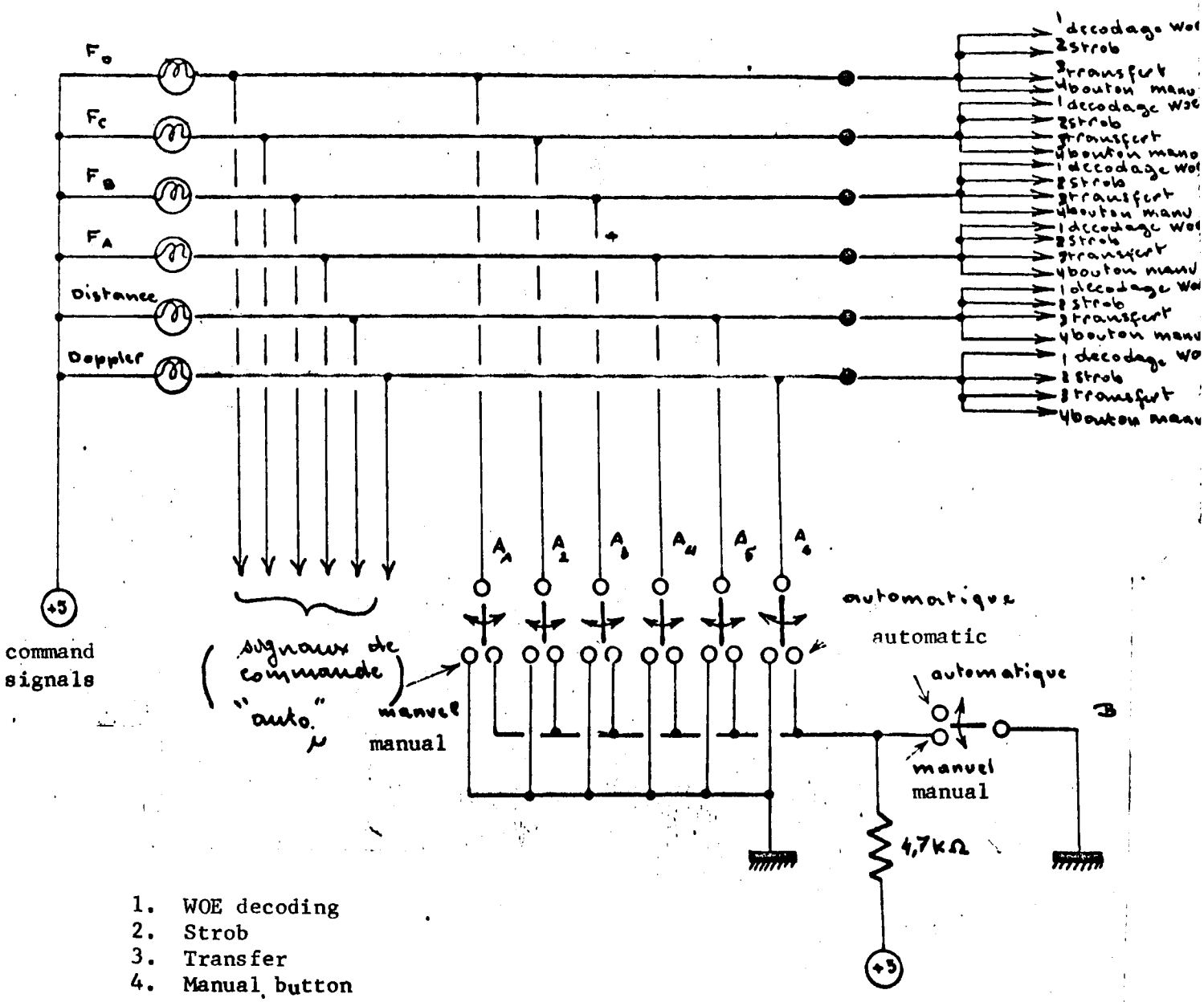
3.3 Automatic-manual command

One has made the choice of the following conventions for the "$auto_i$" signal.

In automatic: "$auto_i$" = "1"

In manual: "$auto_i$" = "0"

The circuit adopted is the following



1. WOE decoding
2. Strob
3. Transfer
4. Manual button

Functioning

By the set of interruptors one can have a command curiously manual, entirely automatic, or a combination of the two.

Interruptor B being on "automatic" and the interruptors A_i ($i = 1_1 \ldots C$) on "automatic" the command is automatic.

Interruptor B on "auto" the A_i on "auto" or "manual" or a combination of the two one has a mixed command.

Interruptor B on "manual" the A_i on "auto" or "manual" one has a manual command.

Utilization

The signals of command will be validated

a) The decommutation of switching (WOC)

$$\overline{W_i} \cdot \text{"Auto}_i\text{"}$$

b) The transfer of automatic information on the charge circuit of the plug register by means of the signal

$$\overline{W_i} \cdot \text{"Auto}_i\text{"}$$

c) The charge of the bistables of the plug register (attacks a RS and strob) by means of the signal

$$\overline{W_i} \cdot \text{"Auto}_i\text{"}$$

d) The sending of the bit "1" by transmitting the mass to the manual sending buttons.

Remarks

The mass is representative of bit "1" in manual command.

In the manual position one lights signals (Doppler manual: Doppler lighted signal).

4. Charge of the plug register and visualization

4.1 Charge of the plug register

4.1.1 Circuit "on"

4.1.1.1 Principle

One should be able to transmit two kinds of information either manual or automatic.

One has seen that the automatic information is of the form

$$S\mathcal{C}_{ji} = \perp_j \cdot \overline{W_i : \text{"Auto"}_i} \cdot Auto_i$$

For the manual information

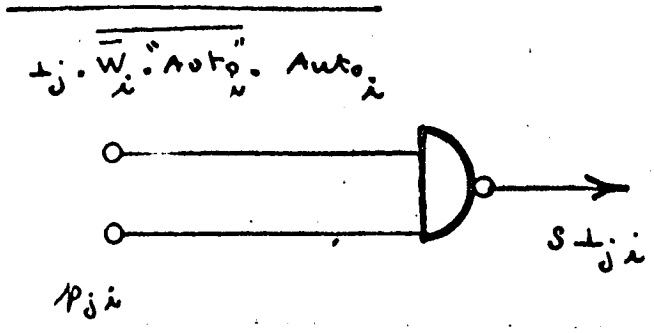
$$S\mathcal{C}_{ji} = P_{ji} \quad \left\{ P_{ji} = \text{bit "0" ou "1"}_{ji} \qquad \begin{array}{l} i = Dop, Dist, \ldots Fd \\ j = 1,2,3 \end{array} \right\}$$

One realizes the function

$$S\perp_{ji} = \overline{S\mathcal{C}_{ji}} + \overline{S\mathcal{C}_{ji}}$$

$$S\perp_{ji} = \perp_j \cdot \overline{W_i : \text{"Auto"}_i} \cdot Auto_i + \overline{P_{ji}}$$

4.1.1.2 Realization

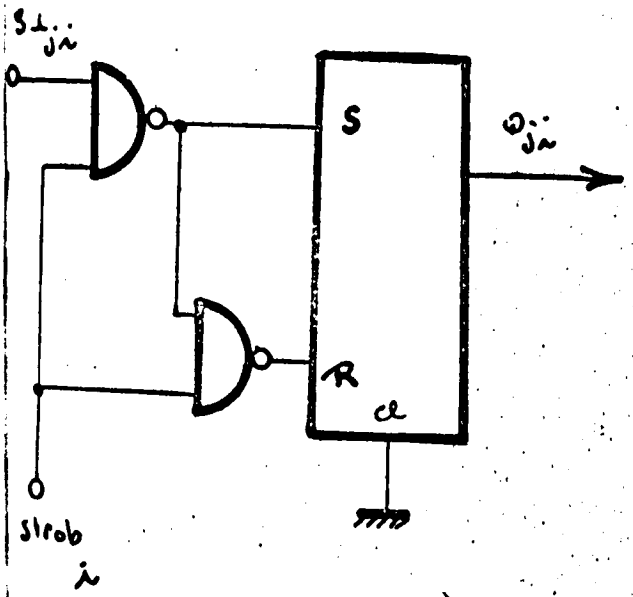


This circuit is in three copies for each simulation.

4.1.2 Charge of the plug register

This register is formed of 18 bistables attacked in RS as it is indicated below

$$Q_{ji} = S_{ji} \qquad j = 1,2,3$$
$$i = Dop, Dut \ldots F_{el}$$



This 18 bistable register is divided in six elementary registers of 3 bistables where the information is stored (simulation).

Strob values

$$Strob_{dp} = \overline{\overline{W}_{dp} \cdot \text{"Auto"}_{dp}}$$

$$Strob_{d} = \overline{\overline{W}_{d} \cdot \text{"Auto"}_{d}}$$

$$Strob_{F_a} = \overline{\overline{W}_{f_a} \cdot \text{"Auto"}_{f_a}}$$

$$Strob_{F_b} = \overline{\overline{W}_{f_b} \cdot \text{"Auto"}_{f_b}}$$

$$Strob\ F_c = \overline{\overline{W}_{f_c} \cdot \text{"Auto"}_{f_c}}$$

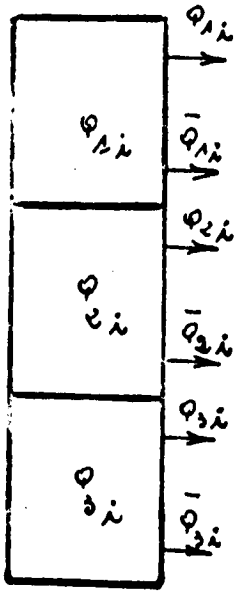
$$Strob\ F_d = \overline{\overline{W}_{f_d} \cdot \text{"Auto"}_{f_d}}$$

Remarks

The information contained in the six 3 bit registers will be sent toward the slides charged with the treatment by thread worm connections.

4.2 Visualization

One has considered visualizing the levels of simulation. As is indicated below

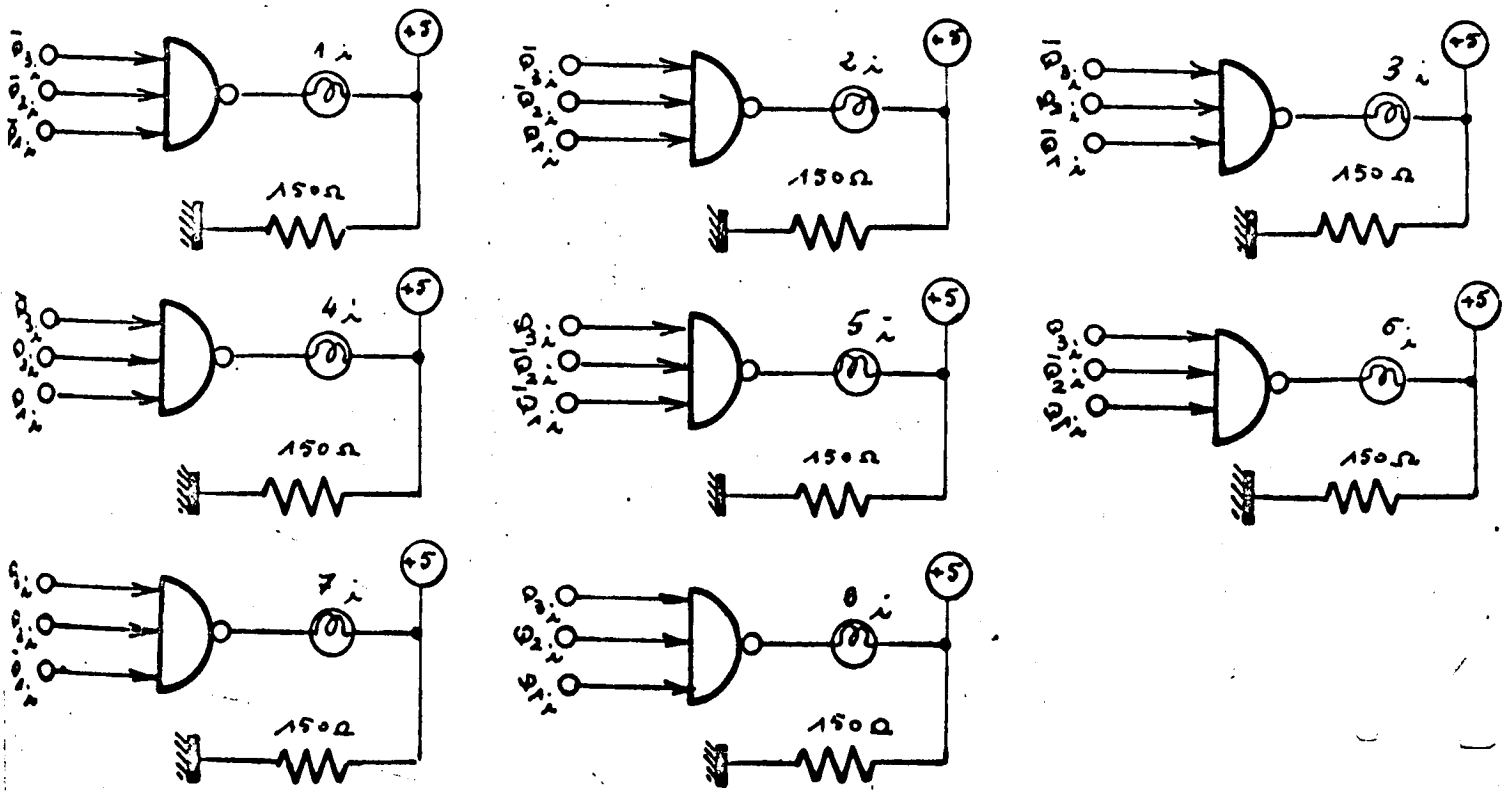


φ_{1i}	φ_{2i}	φ_{3i}	Lighted number chiffre allumé
0	0	0	1
1	0	0	2
0	1	0	3
1	1	0	4
0	0	1	5
1	0	1	6
0	1	1	7
1	1	1	8

The visualization of the number (level) is obtained beginning with a CI signal model 70 11 positions.

Realization principle

The decoding is obtained by a round opening of power (buffer)



5. Reconstruction of the balloon answer

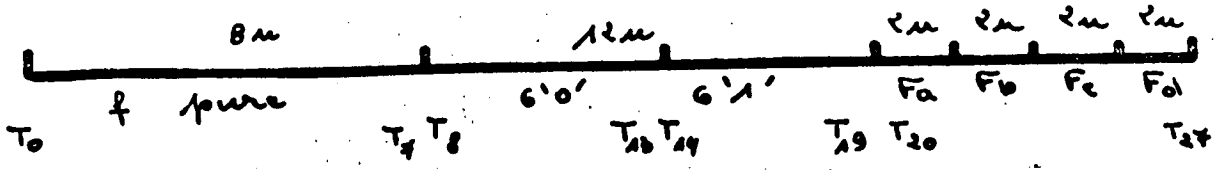
5.1 Generalities

We arrange in six registers (of 3 bits) bits of command information Doppler, distance, frequencies Fa Fb Fc Fd.

These different parameters are distributed in the distance slides (distance information) VEO (balloon frequencies) and toward the synthetizer (Doppler information).

The mixing of the information is assured by the adaptation slide.

5.1.1 Call of the characteristics of the balloon answer



The 6'0' are made up of six time impulsions modulated by 2304 Hz sinusoidal.

The 6'1' are made up of six time impulsions modulated by 2688 Hz sinusoidal.

The F_a, F_b, F_c, F_d frequencies equal or different are contained between 7,5 kHz SU et 10 kHz SU

Each frequency being able to be commanded by three bits thus eight values are available 7530, 7880, 8230, 8580, 8930, 9280, 9630, 9980. Eight oscillators assure this function in the VEO slide. Each of these eight frequencies is commutated in time as a function of the transmitted frequency F_i.

5.2 Pure frequency

During the first eight u ($u = \frac{1}{48}$ sec) the balloon emits a pure frequency. In order to restore this information it is sufficient not to send video to the synthetizer during the timing $T_o + T_1 + \ldots + T_7$.

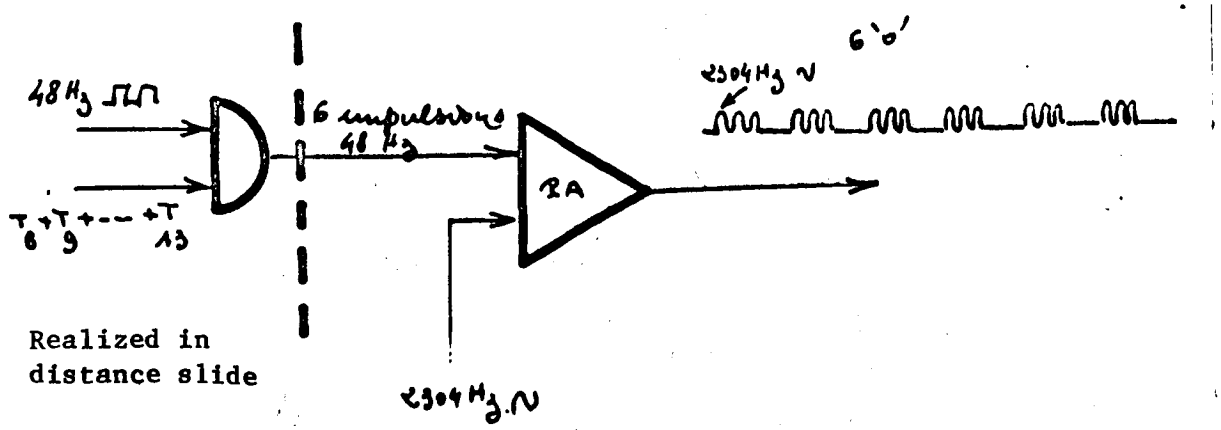
5.3 6'0' 6'1'

5.3.1 6'0'

5.3.1.1 Principle

During the tuning $T_8 + T_9 + \ldots T_{13}$ one modulates the time train by a frequency 2304 Hz u.

Principle of realization



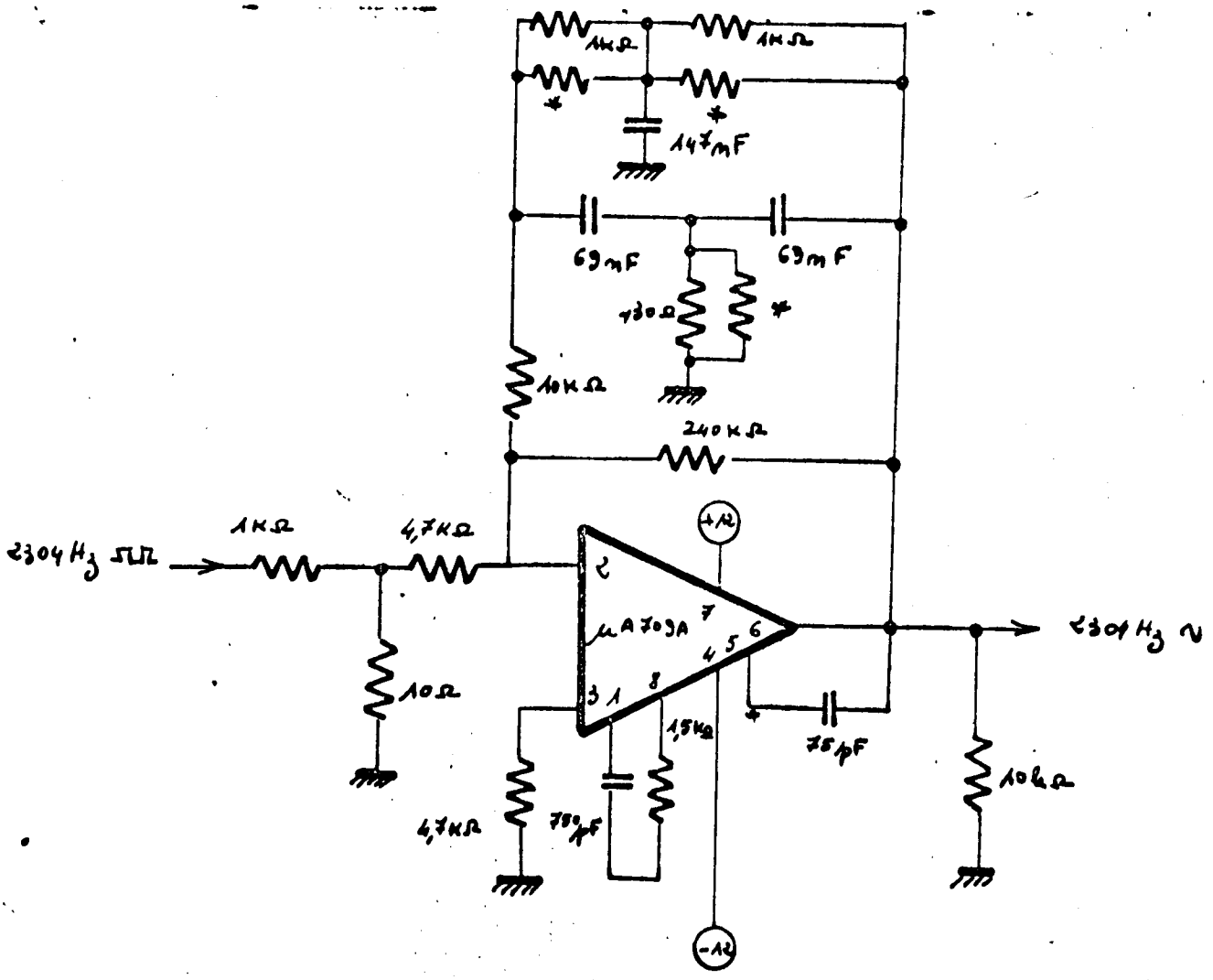
Realized in distance slide

5.3.1.2 Realization

From the distance simulation slide we have the 48 Hz, the 2304 Hz ⎍⎍ and the timing. $T_8+T_9+\cdots+T_{13}$. It concerns first obtaining the 2304 Hz sinusoidal then modulating in an analogical opening commanded by the covering 6'0'.

5.3.1.2.1 Filter 2304 Hz

The active filter whose schema is indicated assures the transformation of the 2304 Hz ⎍⎍ in 2304 Hz N.



* resistances to be determined at the time of beginning.

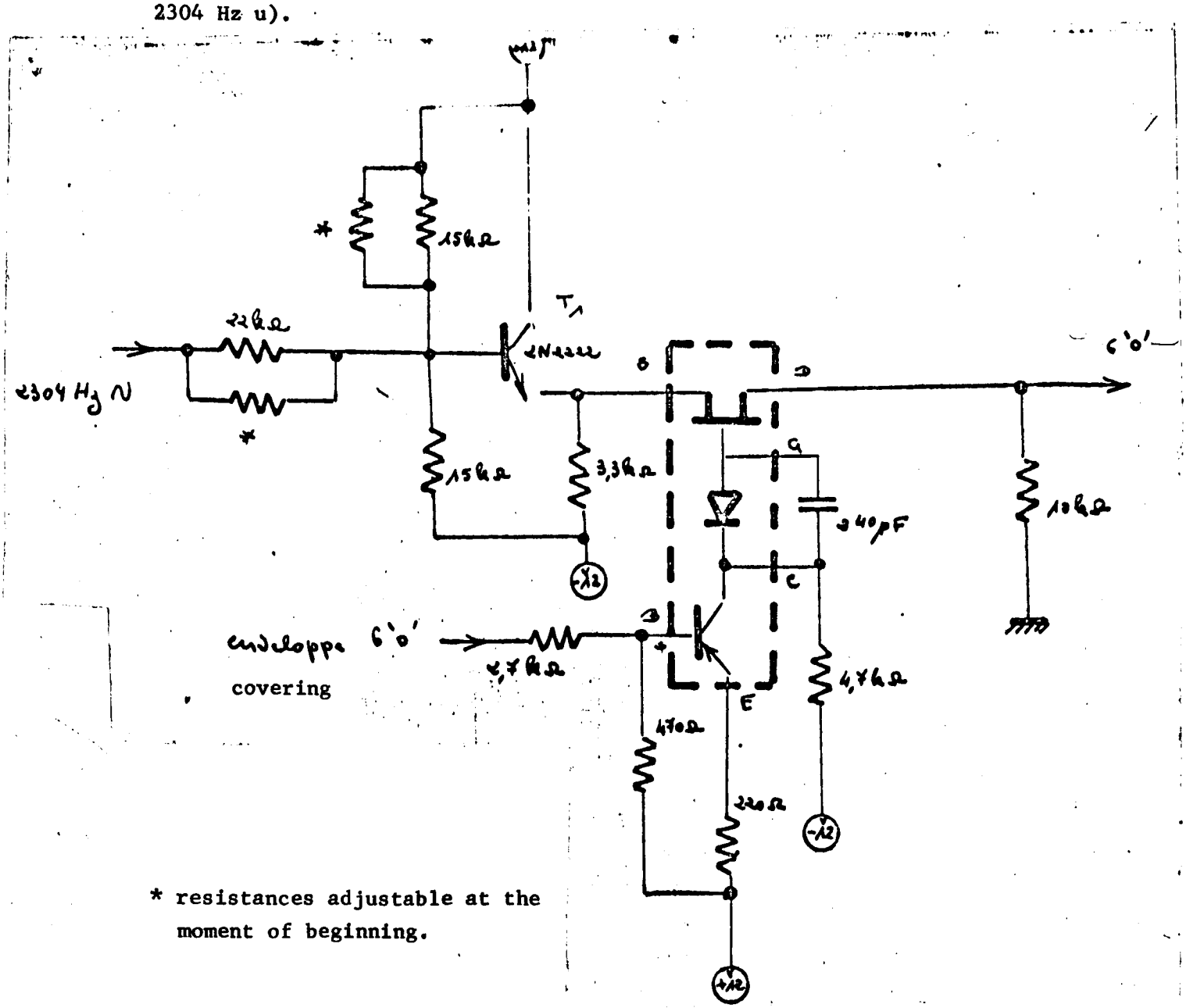
5.3.1.2.2 Modulation 6'0'

The modulation is obtained by an analogical opening 2107 BE. The opening is crowded when one applies a positive impulsion on the base of the opening transistor.

The opening will be rendered crowded by the 6'0' covering coming from the distance slide.

The signal 2304 Hz v attacks by means of the transister T_1 the source of the field effect.

As a product of the field effect one finds the 6'0' (6 packets of 2304 Hz u).



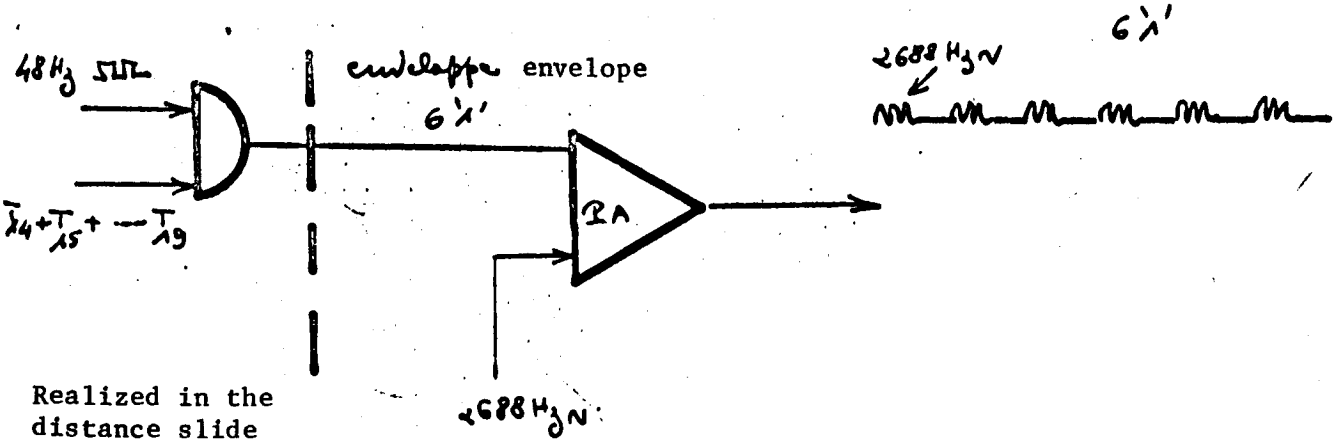
* resistances adjustable at the moment of beginning.

5.3.2 6'1'

5.3.2.1 Principle

During the timing $T_{14} + T_{15} + \text{---} T_{19}$ one modulates the time train by a frequency 2688 Hz u.

Principle of realization



Realized in the distance slide

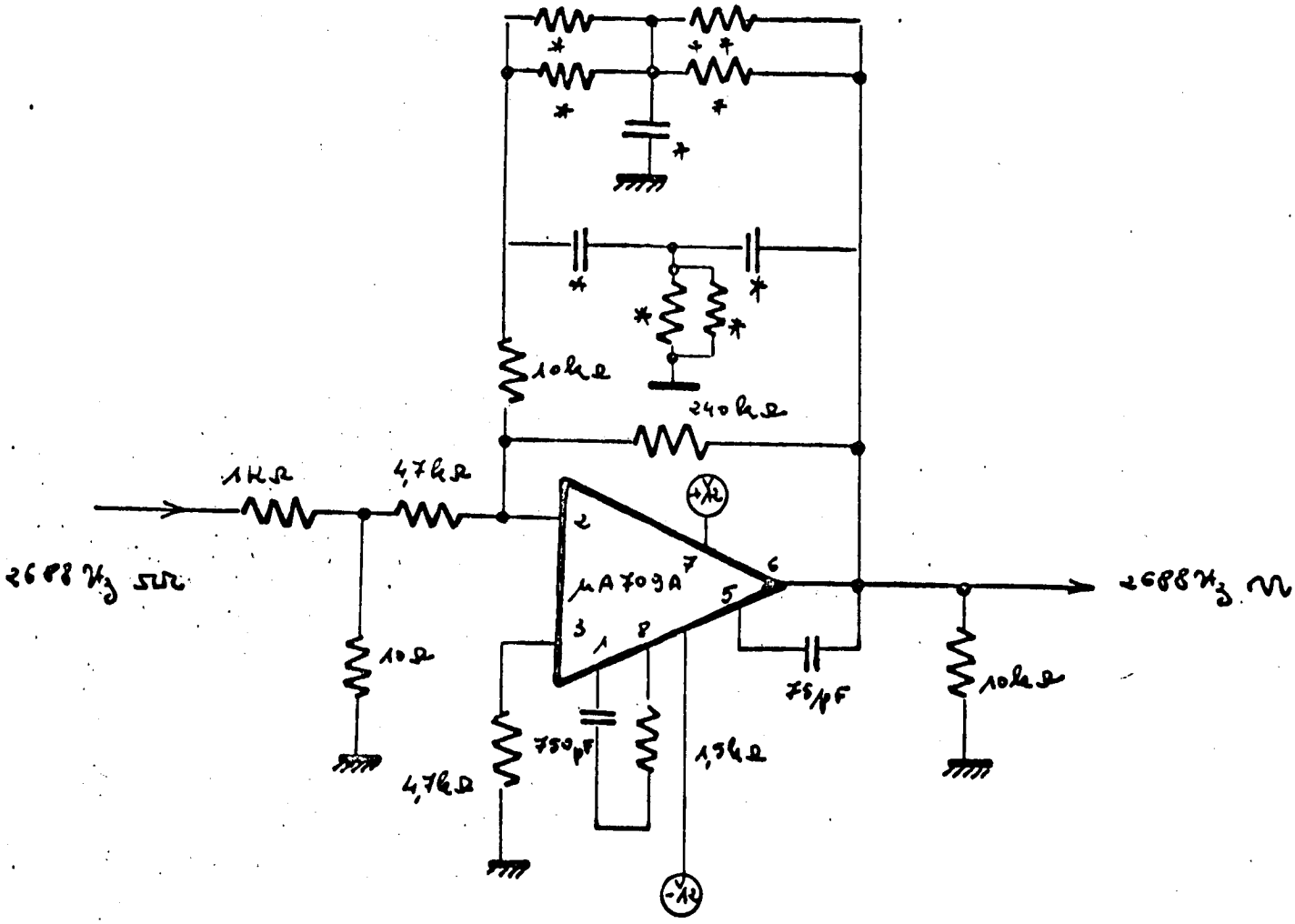
5.3.2.2 Realization

The distance simulation slide furnishes a covering of the 6'1' and the frequency 2688 Hz ⎍⎍. (covering 6'1' $T_{14} + T_{15} + \text{---} T_{19}$)

It concerns first obtaining the 2688 Hz v then modulating an analogical opening commanded by the covering 6'1'.

5.3.2.2.1 Filter

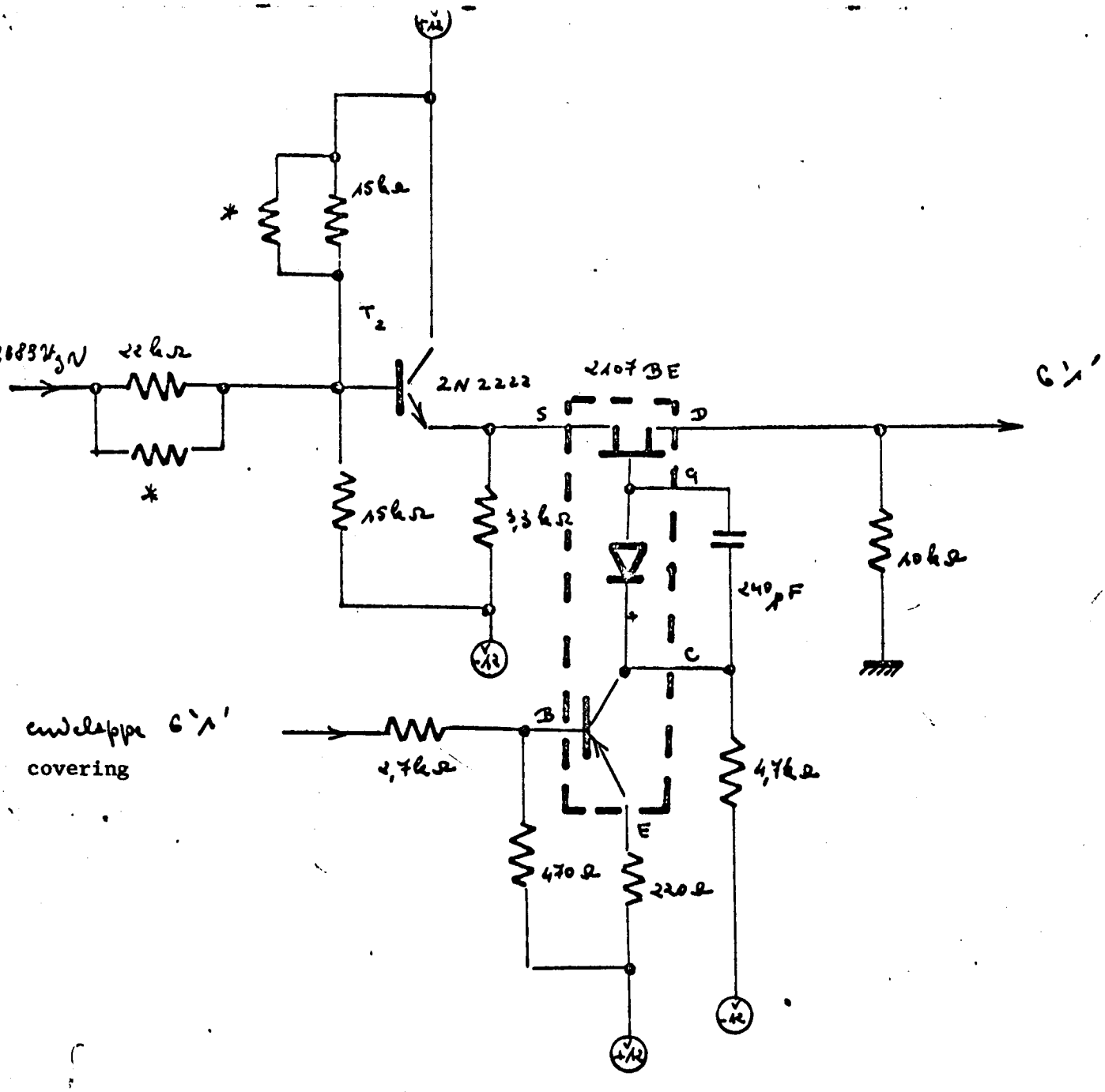
The active filterwhose schema is indicated assures the transformation of the 2688 Hz ⎍⎍ in 2688 Hz v.



* The salter of the elements will be clarified at the beginning.

5.3.2.2.2 Modulation 6'1'

The 6'1' modulation is obtained by an analogical opening 2107 BE. The opening will be crowded when one applies the covering 6'1' on the base of the open transistor.



* The value of the elements is to be clarified at the beginning.

5.4 Balloon frequencies F_a, F_b, F_c, F_d

5.4.1 Calls

During 8 u the balloon emits four frequencies (four times 2 u)

$T_{20} + T_{21} + \text{—} T_{27}$.

During the timing $T_{20} + T_{21}$ the balloon emits F_a

During the timing $T_{22} + T_{23}$ the balloon emits F_b

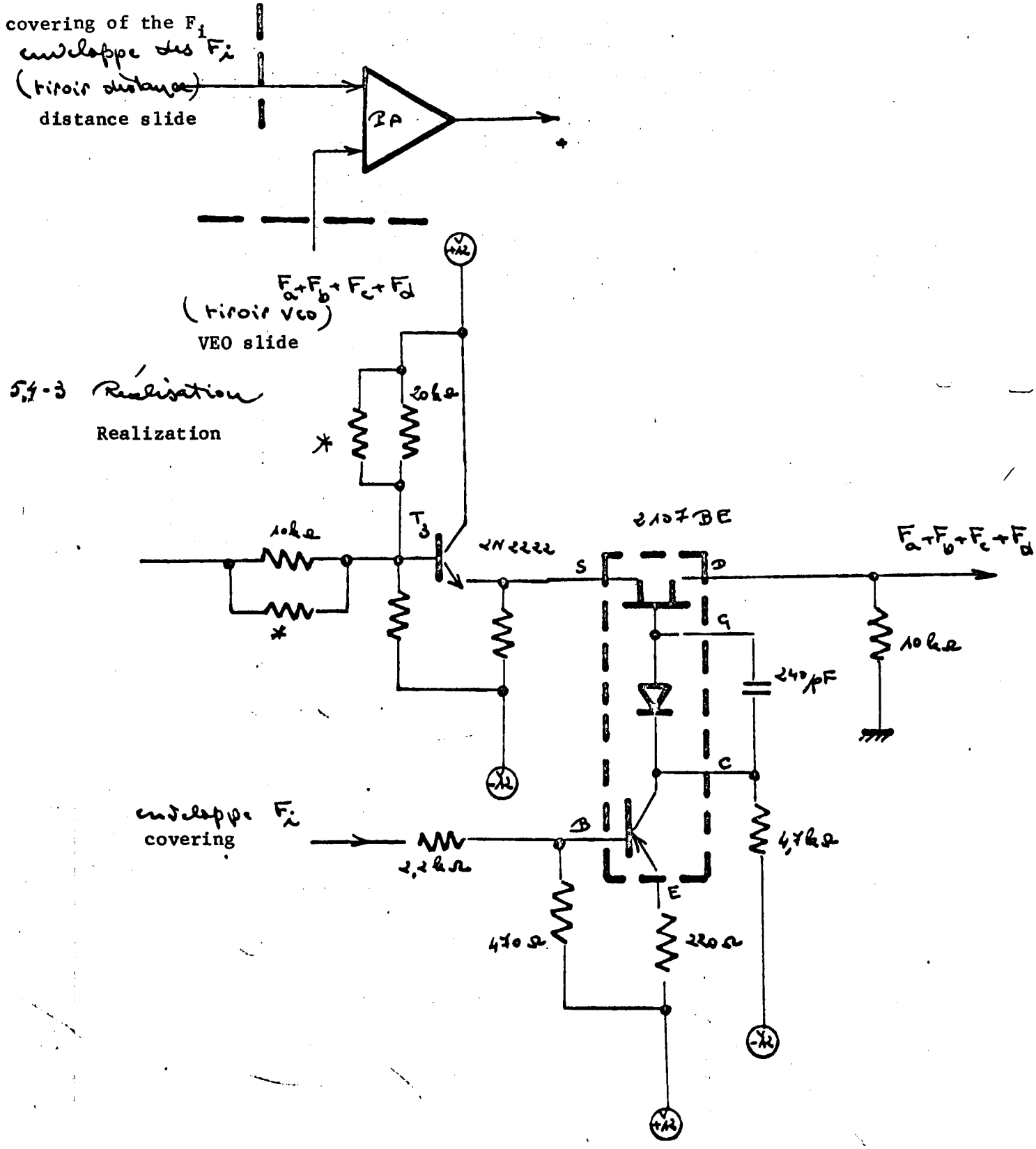
During the timing $T_{24} + T_{25}$ the balloon emits F_c

During the timing $T_{26} + T_{27}$ the balloon emits F_d

5.4.2 Principle of realization

From the VEO slide the train of the four multiplex frequencies is available. On the other hand the distance slide furnishes the covering of the frequencies F_i (i = a, b, c, d).

An analogical opening attacked by the envelope of the F_i assures the passage of the train of frequencies F_i.



5,4-3 Réalisation

Realization

5.5 Mixer

5.5.1 Principle

We use three types of information.

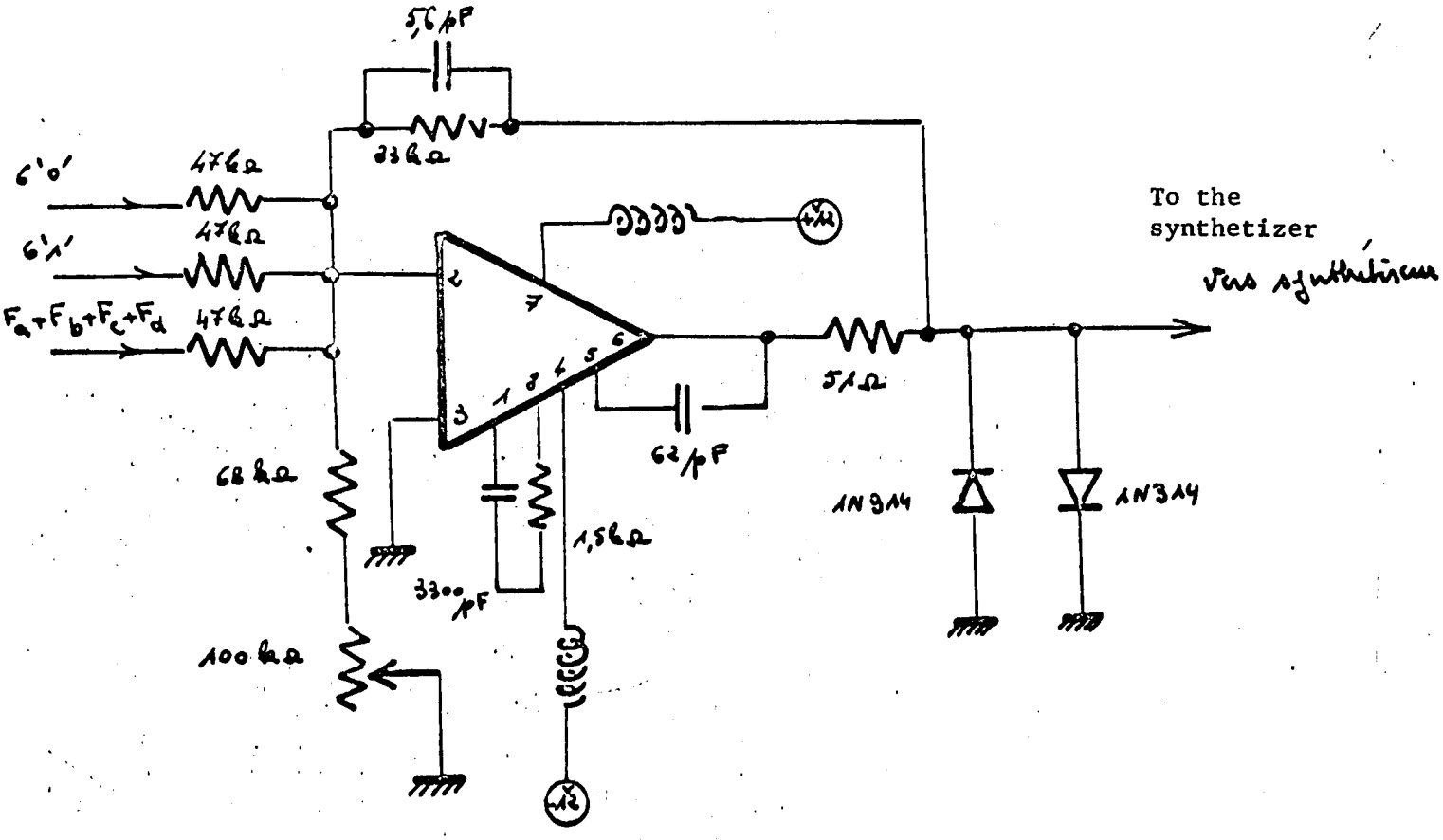
6'0' which appears during the timing $T_8 + T_9 + \text{---} T_{13}$

6'1' which appears during the timing $T_{14} + T_{15} + \text{---} T_{19}$

$F_a + F_b + F_c + F_d$ which appears during the timing $T_{20} + T_{21} + \text{---} T_{24}$

The mixture of this information will be obtained by a summary amplifier which also assures the adaptation of the levels for the attack of the synthetizer.

5.5.2 Realization



5.6 Doppler

5.6.1 Principle

The balloon satellite connection being blemished by the Doppler, guiding the central frequency of the synthetizer has been anticipated. The frequency trip of the Doppler is ± 20 kHz around the central frequency. It is accomplished in eight levels (3 bits). Each level corresponds to the decoding of one of the eight conditions of the Doppler register.

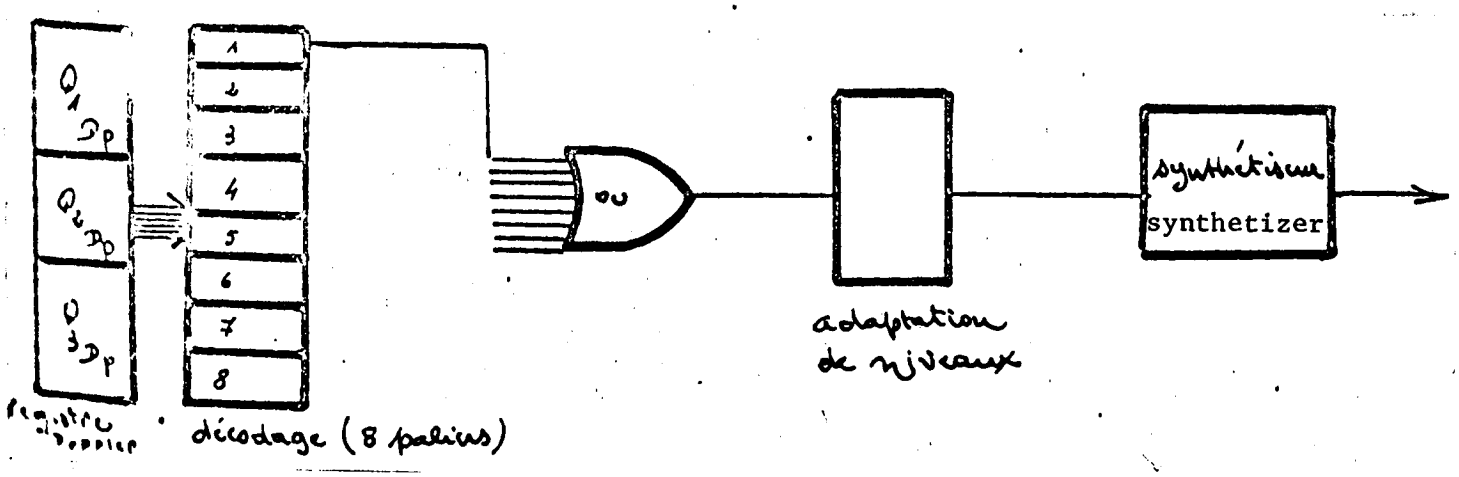
Frequencies examined

401,703 0216 MHz	(8)	(palier 8) level 8	$\mathcal{D}p = -10,9384$ kHz
401,708 0216 MHz	(7)		$\mathcal{D}p = -9,9384$ kHz
401,713 0216 MHz	(6)		$\mathcal{D}p = -4,9384$ kHz
401,718 0216 MHz	(5)		$\mathcal{D}p = +0,0006216$ kHz
401,717 9600 MHz	fréquence centrale central frequency		
401,723 0216 MHz	(4)		$\mathcal{D}p = +5,0616$ kHz
401,728 0216 MHz	(3)		$\mathcal{D}p = +10,0616$ kHz
401,733 0216 MHz	(2)		$\mathcal{D}p = +15,0616$ kHz
401,738 0216 MHz	(1)	(palier 1) level 1	$\mathcal{D}p = +20,0616$ kHz

5.6.2 Realization

5.6.2.1 Principle

The principle of realization is represented below.



Adaptation of levels

Doppler register

Decoding (8 levels)

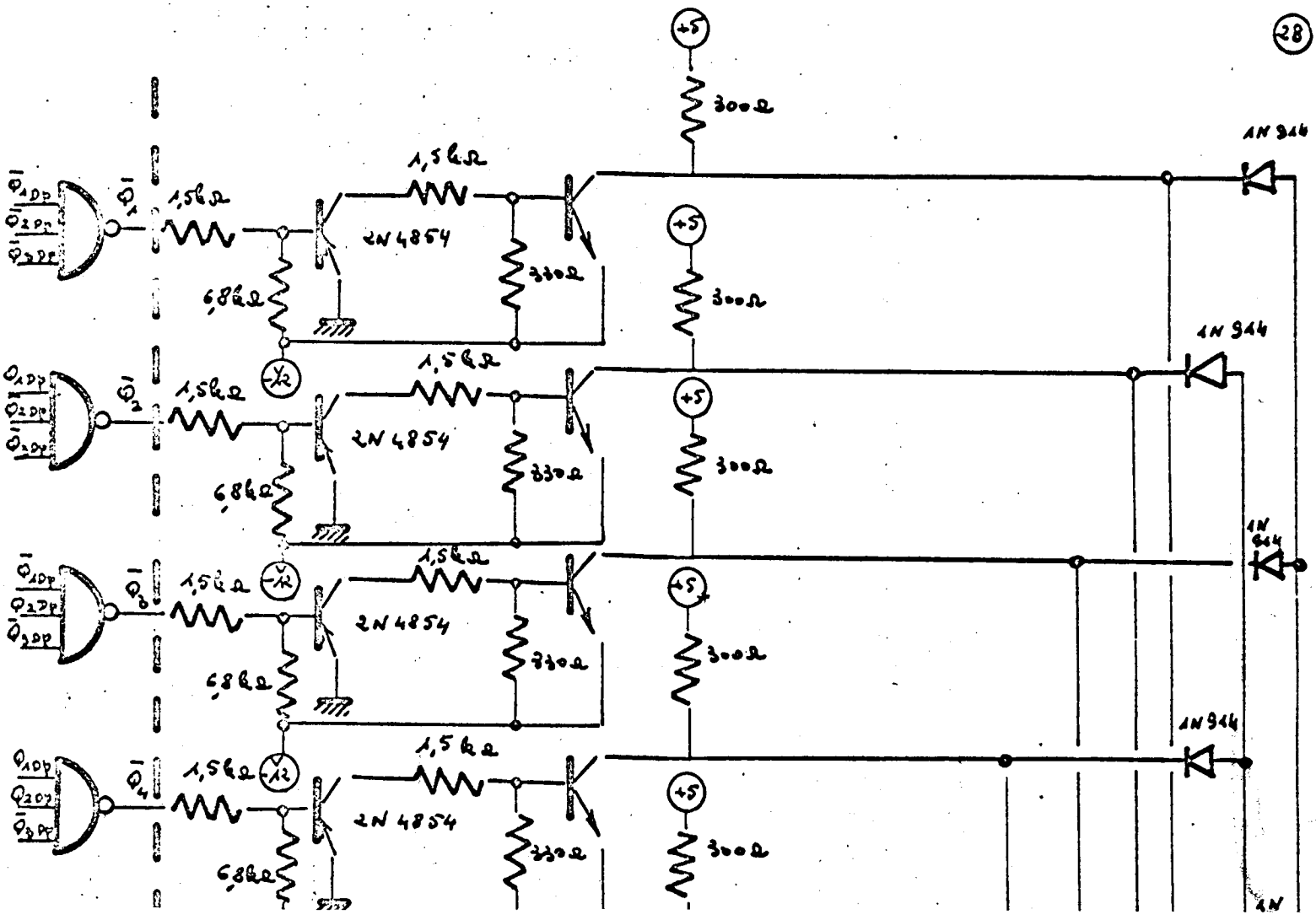
5.6.2.2 Decoding (8 levels)

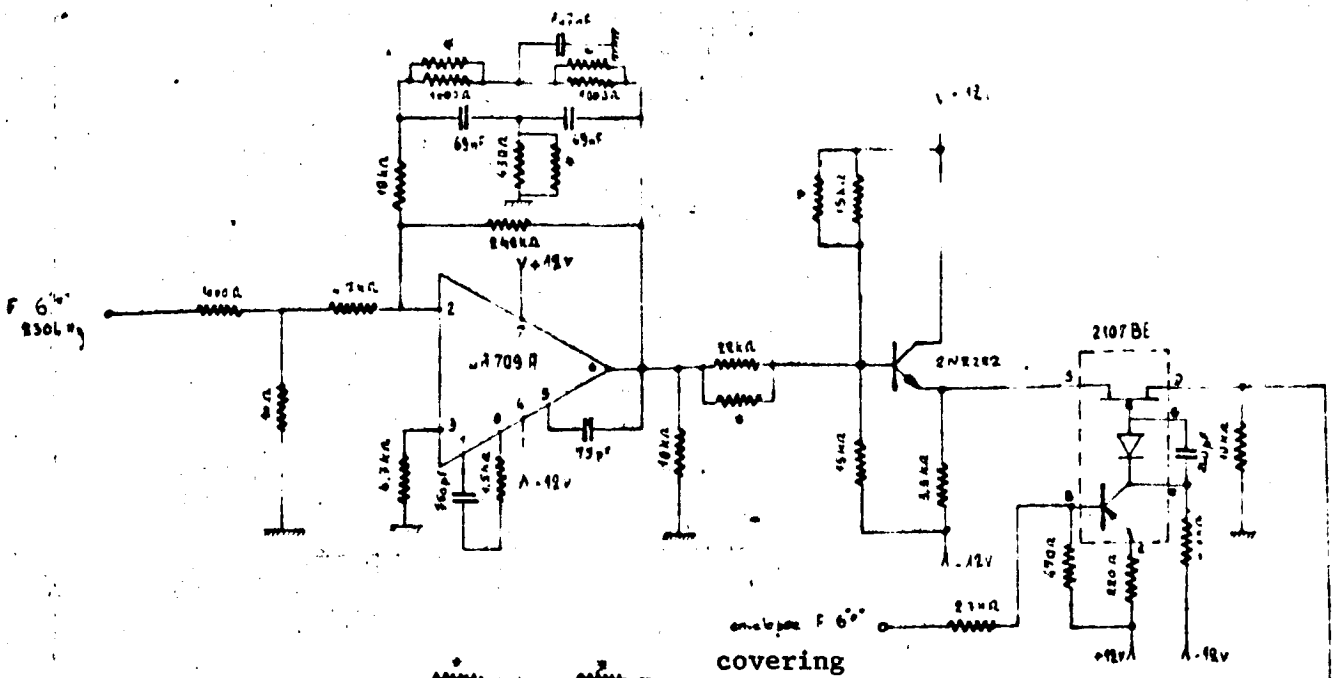
$Q_{1_{D_P}}$, $Q_{2_{D_P}}$, $Q_{3_{D_P}}$ are the three bits contained in the Doppler register ($Q_{1_{D_P}}$ slight weight, $Q_{3_{D_P}}$ great weight) we arrange thus eight conditions which one decodes.

$$
\begin{aligned}
Q_1 &= \overline{Q_{1_{D_P}}} \cdot \overline{Q_{2_{D_P}}} \cdot \overline{Q_{3_{D_P}}} \\
Q_2 &= Q_{1_{D_P}} \cdot \overline{Q_{2_{D_P}}} \cdot \overline{Q_{3_{D_P}}} \\
Q_3 &= \overline{Q_{1_{D_P}}} \cdot Q_{2_{D_P}} \cdot \overline{Q_{3_{D_P}}} \\
Q_4 &= Q_{1_{D_P}} \cdot Q_{2_{D_P}} \cdot \overline{Q_{3_{D_P}}} \\
Q_5 &= \overline{Q_{1_{D_P}}} \cdot \overline{Q_{2_{D_P}}} \cdot Q_{3_{D_P}} \\
Q_6 &= Q_{1_{D_P}} \cdot \overline{Q_{2_{D_P}}} \cdot Q_{3_{D_P}} \\
Q_7 &= \overline{Q_{1_{D_P}}} \cdot Q_{2_{D_P}} \cdot Q_{3_{D_P}} \\
Q_8 &= Q_{1_{D_P}} \cdot Q_{2_{D_P}} \cdot Q_{3_{D_P}}
\end{aligned}
$$

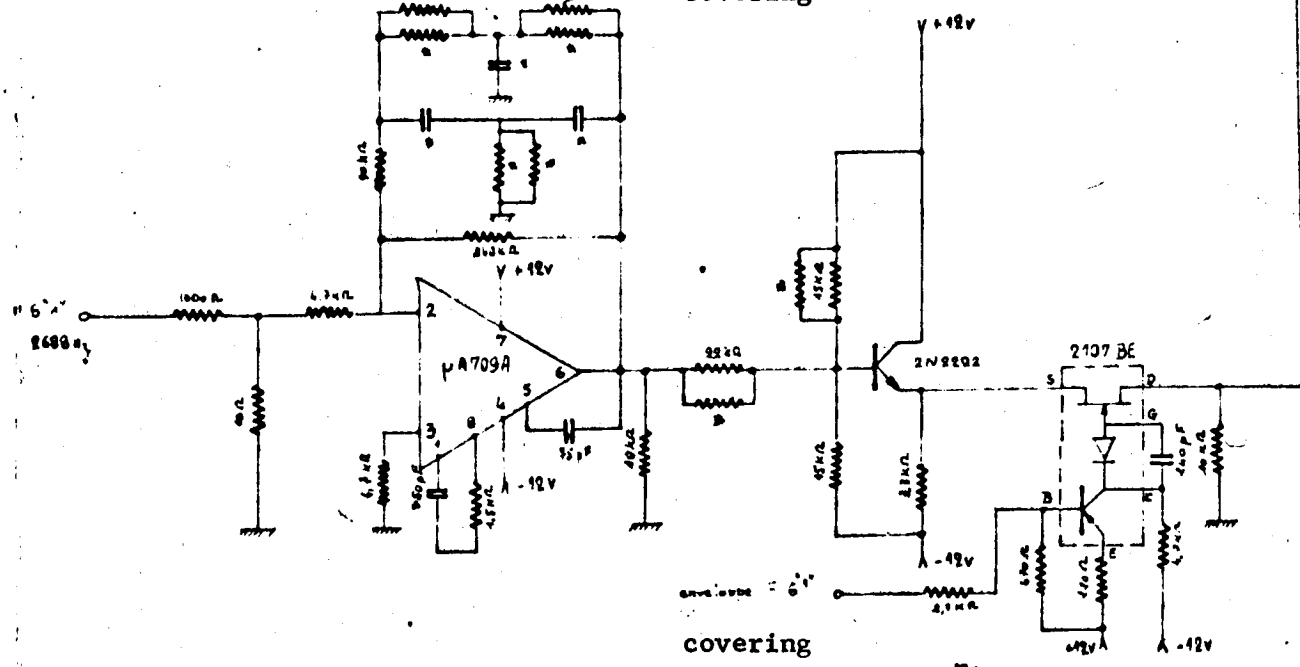
5.6.2.3 Adaptation of the levels

The decodings $\overline{Q}_i$ (i = 1,2...8) attack eight circuits of formation which attack the synthetizer on six wires. The presence of a single one of the decodings $\overline{Q}_i$ permits the variation of the central frequency.

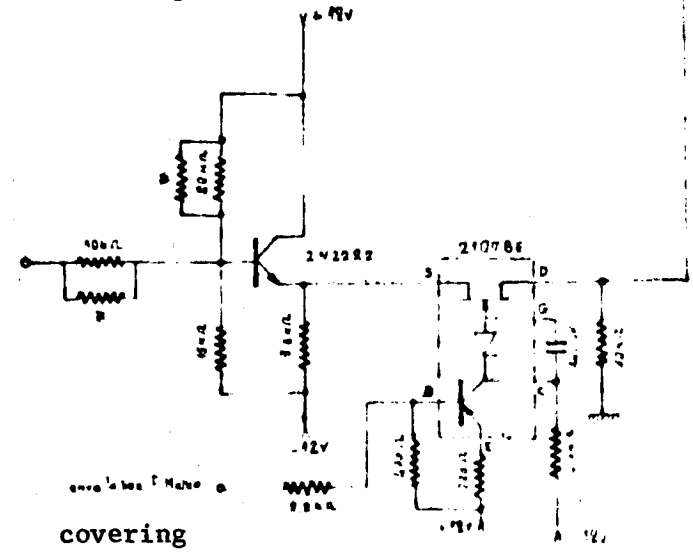




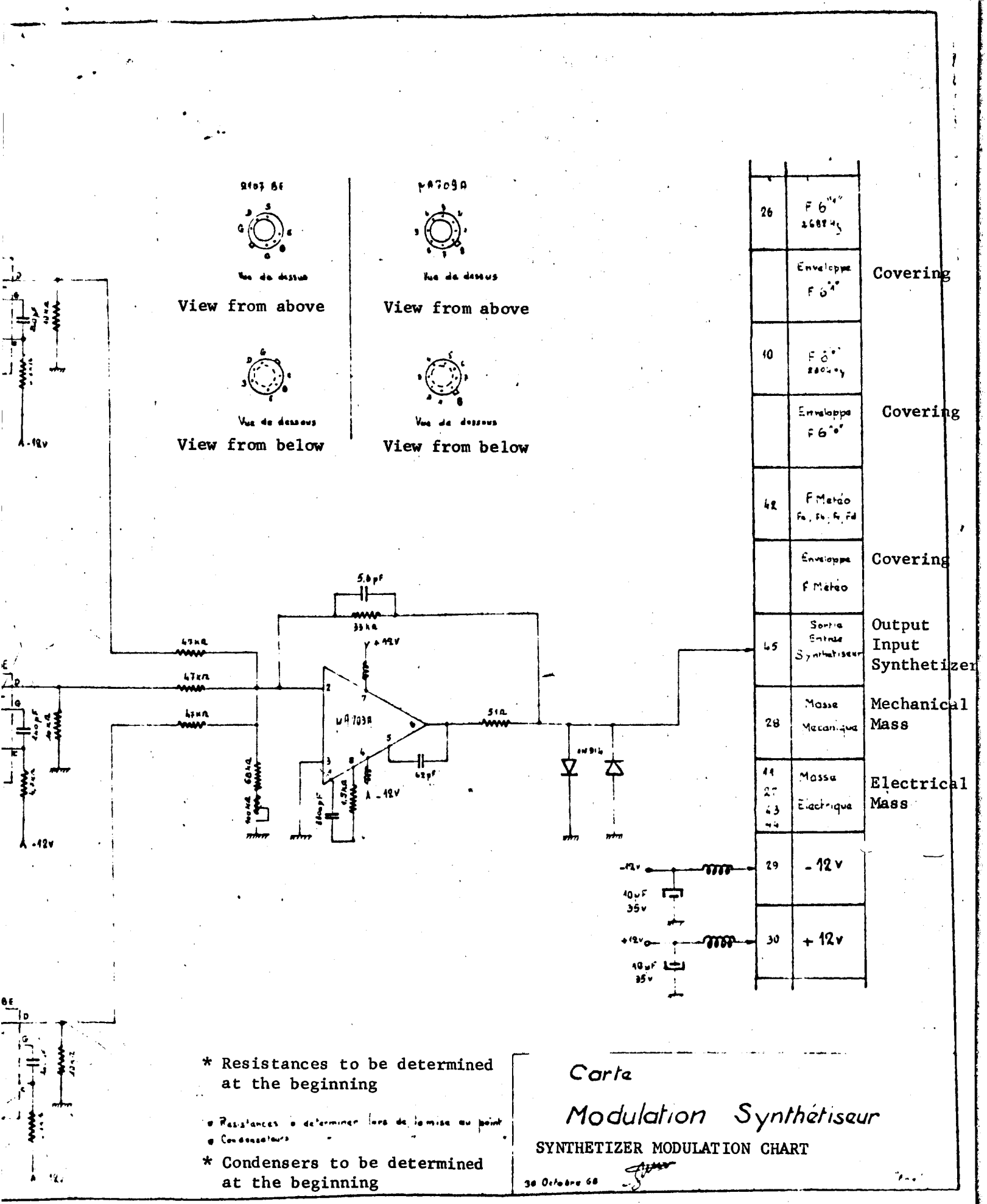
covering



covering



covering



* Resistances to be determined at the beginning

* Résistances à déterminer lors de la mise au point

* Condensateurs

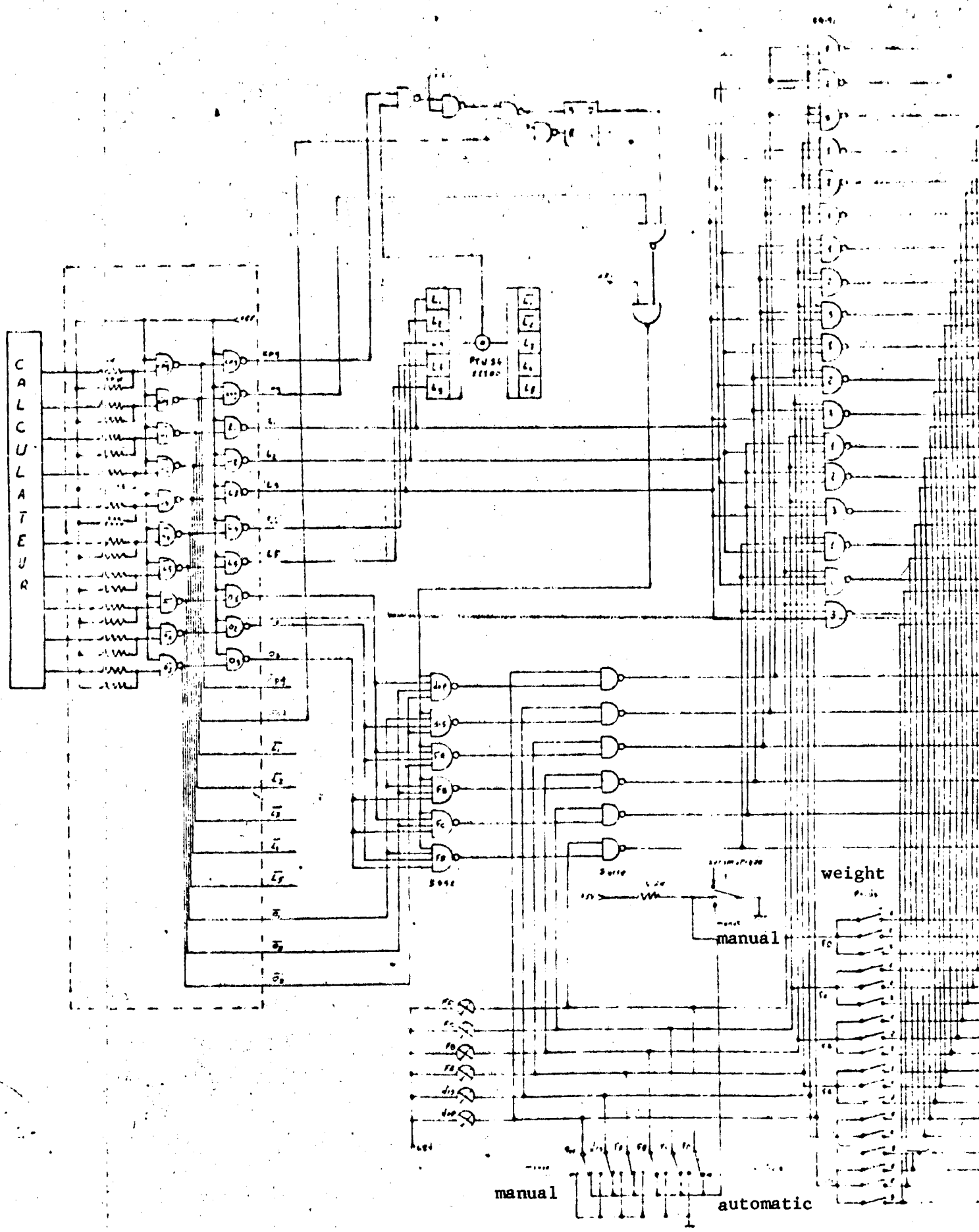
* Condensers to be determined at the beginning

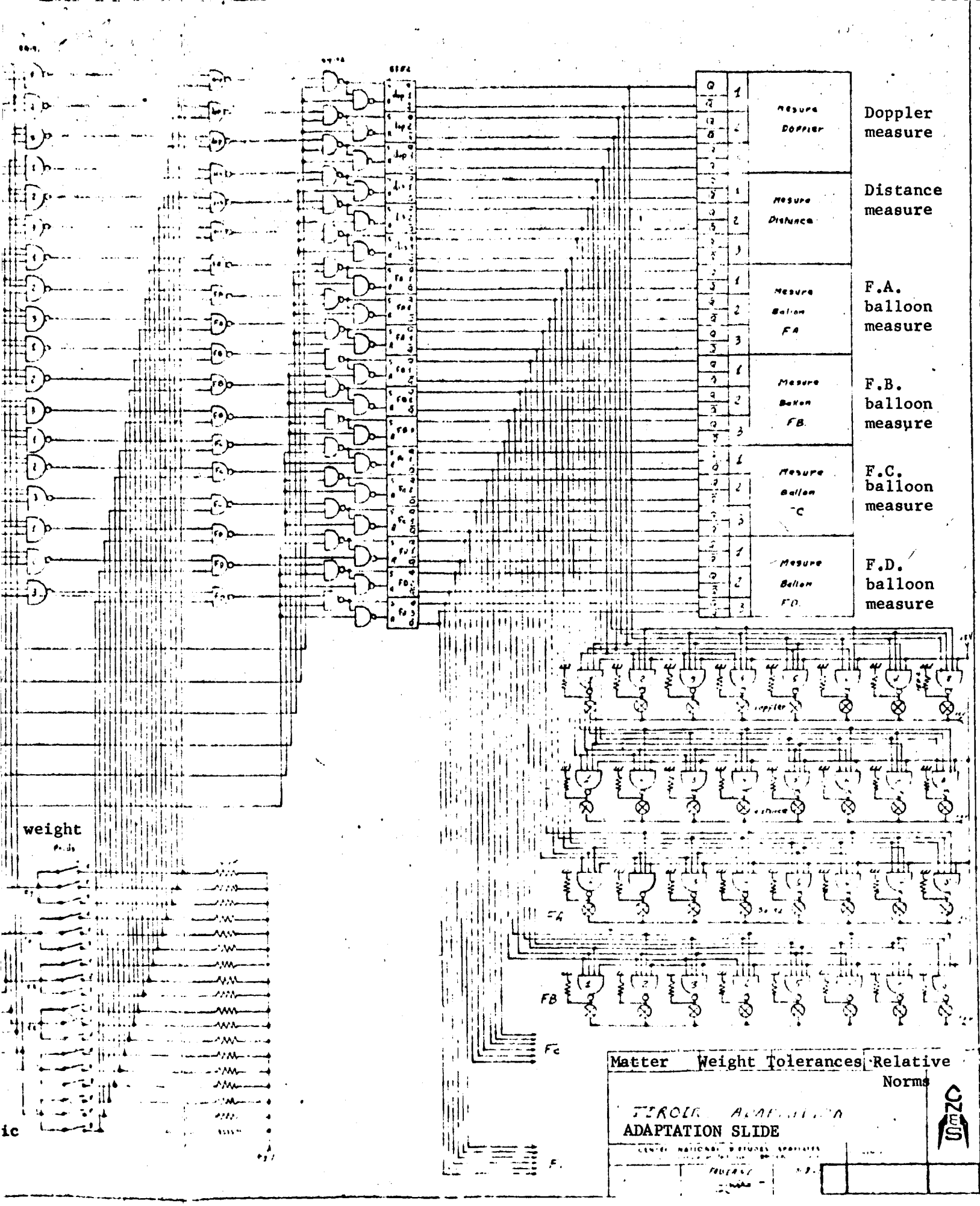
Carte

Modulation Synthétiseur

SYNTHETIZER MODULATION CHART

30 Octobre 68


CALCULATEUR
weight
manual
manual
automatic


Doppler measure
Distance measure
F.A. balloon measure
F.B. balloon measure
F.C. balloon measure
F.D. balloon measure
weight
FA
FB
Fc
Matter
Weight Tolerances
Relative Norms
ADAPTATION SLIDE

DISTANCE MEASURE SLIDE

DISTANCE MEASURE SLIDE

1. Generalities
2. Counting (sequential circuit)
3. Coincidence of end of counting
4. RAZ
5. False time base
6. Timing of the balloon response
7. Frequency of counting
8. Levels

1. Generalities

1.1 Goal

One of the missions of the EOLE satellite being the location of the balloons it has appeared indispensable in the realization of the test means to simulate the satellite-balloon distance. In order to do this on the ground during integration we use two frequencies furnished by the satellite to know the 645 K Hz and the 1.6 Hz frequency of the format (see remark on page 18 again).

The distance simulation is obtained by a variable retard corresponding to the time of propagation of the waves in the connection.

1.2 Principle

In order to simulate the satellite-balloon distance one is led to conceive a time base (similar to that of the satellite) which properly retarded will furnish all the timing necessary to sending of the phrase (word unreadable) by the balloon.

On the front mounting of the 1.6 Hz of the satellite one disconnects a counting circuit at the same time as one blocks the annexed time base (called the false time base). When the counting is terminated (by coincidence with the condition of a three bistable register) one unblocks the time base which is found thus to be retarded in a time $\Delta \tau$ corresponding to the time of counting.

1.3 Scale of distance frequency of counting

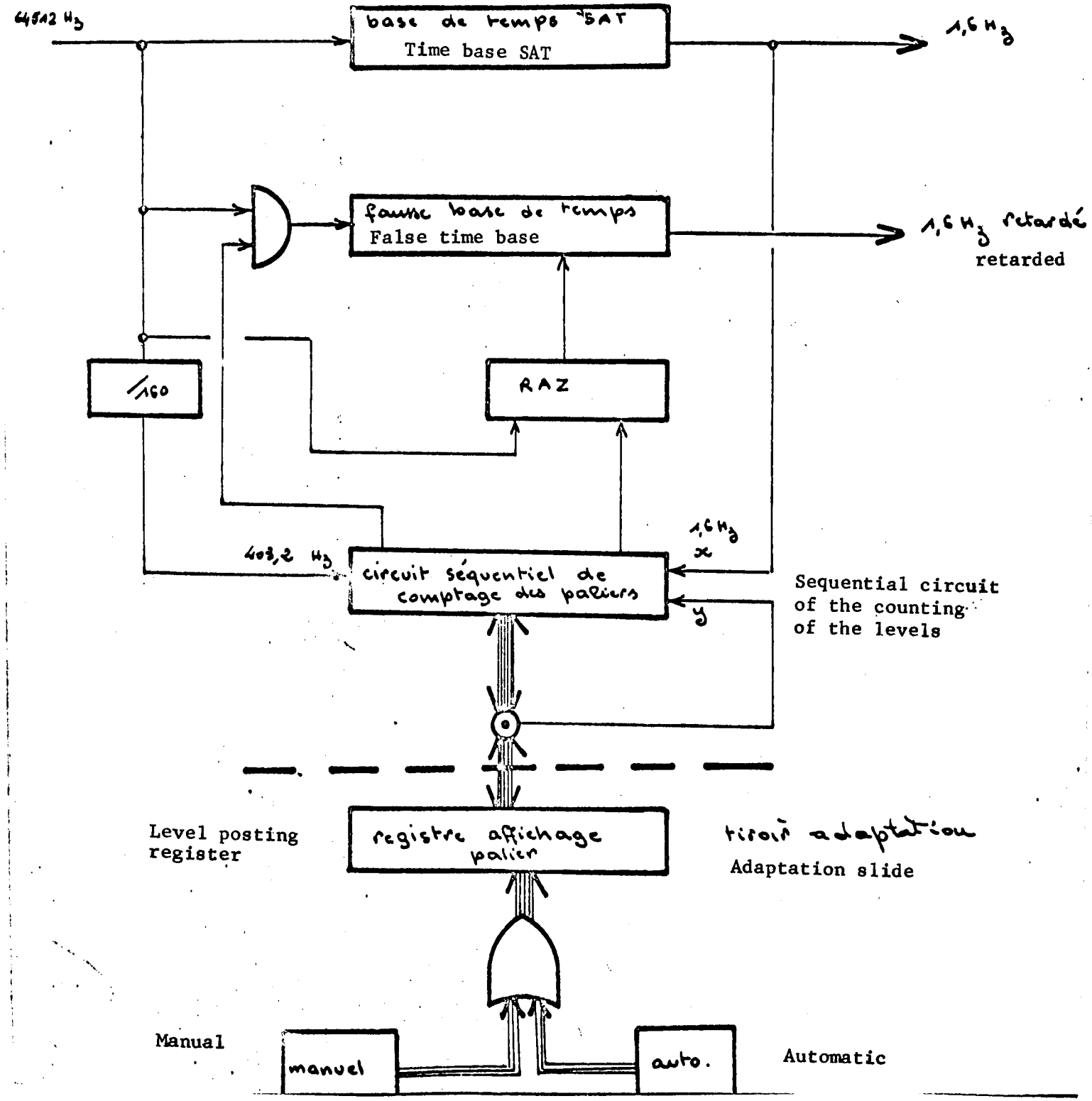
At the nearest the satellite is at 800 km and at the farthest at more than 3200 km from the balloon. Thus it has appeared indispensable to cover this distance by the counting time. A system of 8 levels permits covering this distance. At the farthest the time of propagation is $\frac{1}{48}$ sec which

corresponds to a frequency of 48 Hz. As one wishes to cause the distance to vary on eight levels, the frequency of counting chosen will thus be F = 403.2 Hz for a simulation of 372 km at 2976 km.

1.4 Realization

A sequential circuit counter by eight, attacked by the 1.6 Hz and the coincidence signal (word unreadable) the condition of the three bistables of the counting circuit and that of a register displaying the number of levels desired, assures the divergence in time representative of the distance.

1.5 General schema



1.6 Remark

The level posting register circuits and all of the logic which precedes are a part of a slide called adaptation where the Doppler and HK balloon posting are especially important.

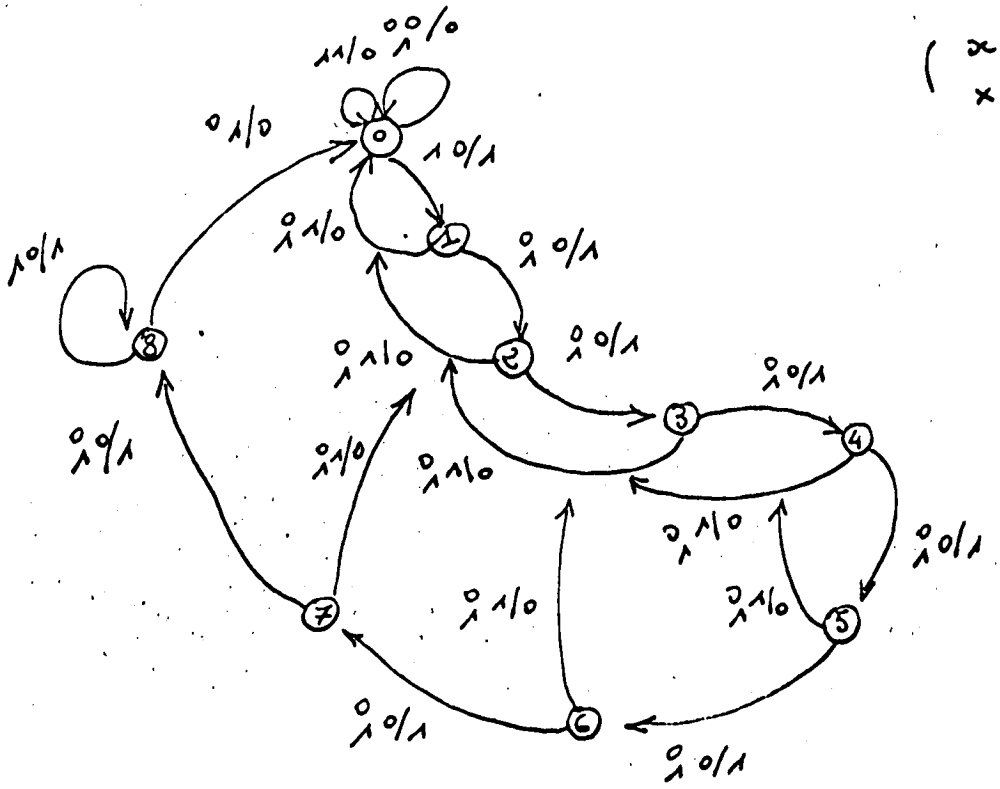
2. Sequential circuit

2.1 Object

The sequential circuit permits obtaining the distance simulation for a counting time - the originality of the system comes from the fact that counting is stopped by the coincidence between the condition of the bistable of the counter and the condition of a register where the number of levels desired is posted.

2.2 Graph

The system being subjected to two inputs of (1.6 Hz) and y (coincidence) the output z is thus a function of x et x y.



le circuit comprend 4 bistables

The circuit contains four bistables.

2.3 Table of truth

n / état	n+1 : x y	x̄ y	x ȳ	x̄ ȳ	z : x̄ y	x̄ ȳ	x ȳ	x̄ ȳ
	0 0	0 1	1 0	1 1	0 0	0 1	1 0	1 1
0	0	0	1	0	0	0	1	1
1	2	0	2	0	1	0	1	0
2	3	0	3	0	1	0	1	0
3	4	0	4	0	1	0	1	0
4	5	0	5	0	1	0	1	0
5	6	0	6	0	1	0	1	0
6	7	0	7	0	1	0	1	0
7	8	0	8	0	1	0	1	0
8	0	0	8	0	0	0	0	0

2.4 Input equations

	A	B	C	D
J	x y	CD	D	Ā x + B + C
K	x̄	CD	0	1

+ clock

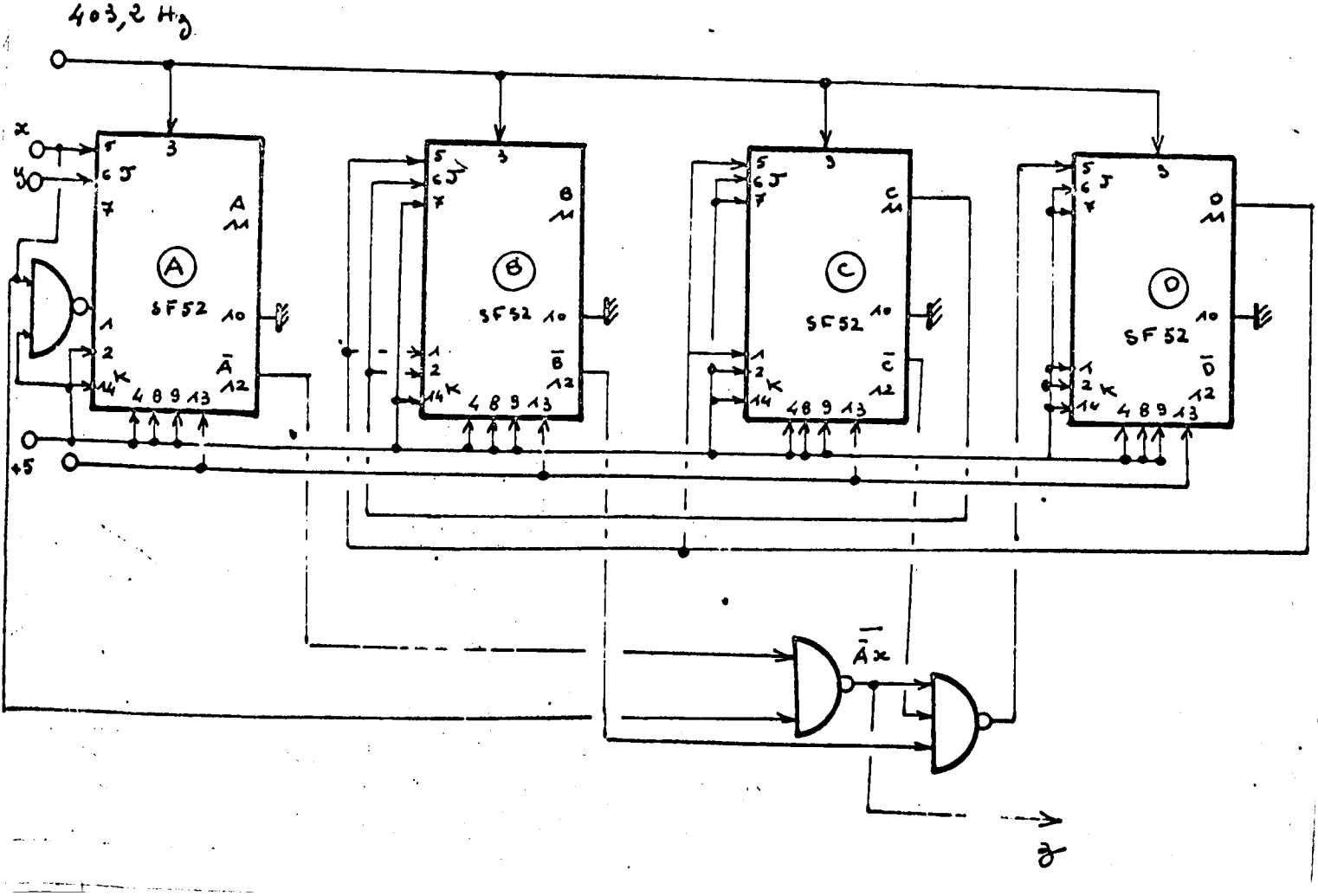
z = A + x̄

clock : clock 403,2 Hz

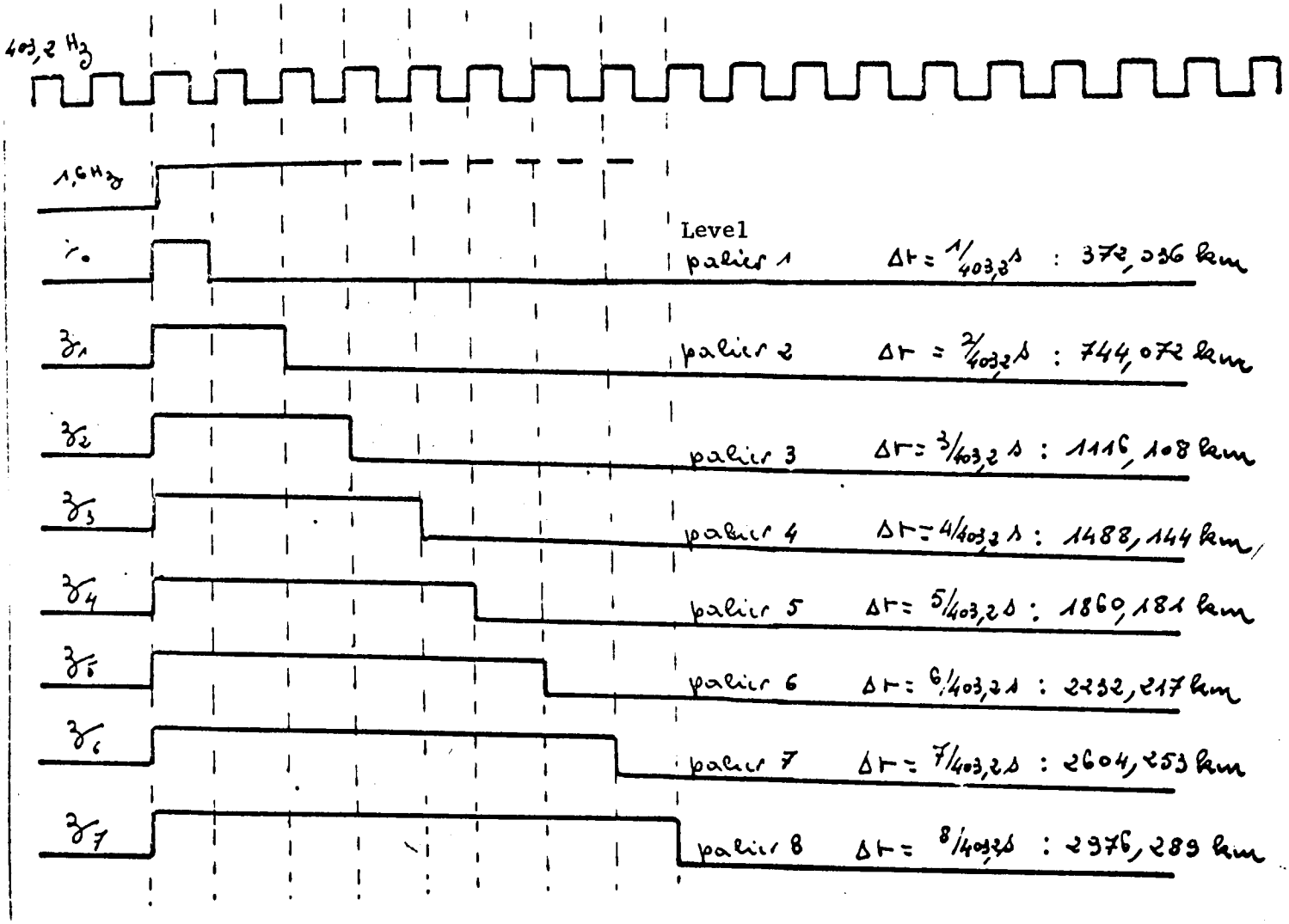
x = 1,6 Hz

y coincidence : coincidence

2.5 Schema



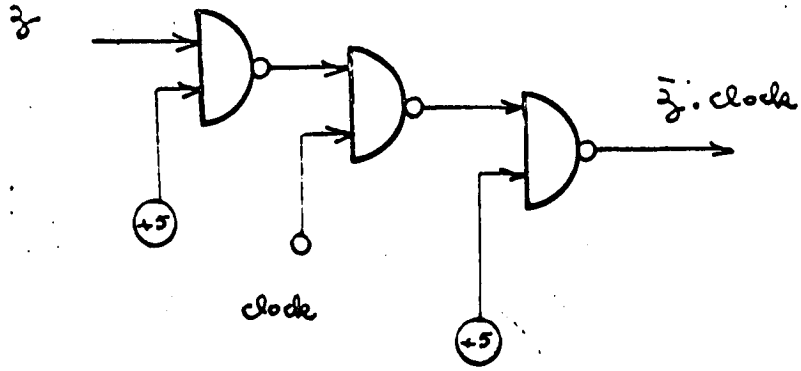
2.6 Diagram



2.7 Blocking of the false time base

During the time of counting the false time base ought to be blocked. For that one anticipates putting at 0 all the clocks of the division chain.

One returns then to a block on the bistables the function "$\bar{z}$. clock".



3. Coincidence of the signal of the end of counting

3.1 Generalities

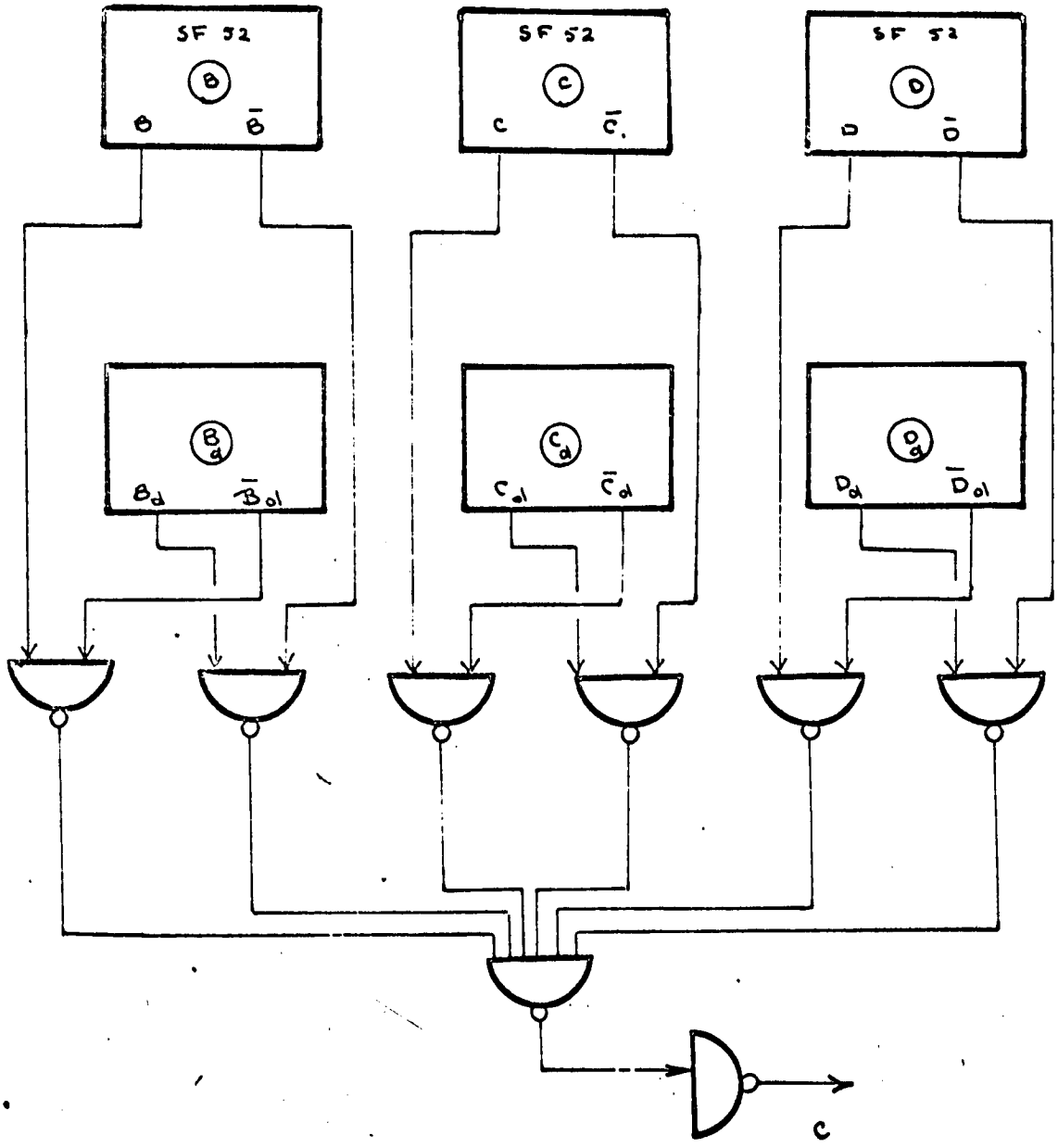
The signal of coincidence is with the 1.6 Hz of the command signals of the sequential circuit.

The signal is obtained by coincidence between the conditions of the bistables B, C and D of the sequential circuit and those of a plug register. (Bistables B_d, C_d, and D_d.)

3.2 Realization

The coincidence function is in the form

$$C = (B B_d + \bar{B} \bar{B}_d)(C C_d + \bar{C} \bar{C}_d)(D D_d + \bar{D} \bar{D}_d)$$


SF 52
B
B
$\bar{B}$
SF 52
C
C
$\bar{C}$
SF 52
D
D
$\bar{D}$
B_d
B_d
$\bar{B}_{01}$
C_d
C_{d1}
$\bar{C}_{d1}$
D_d
D_{d1}
$\bar{D}_{01}$
C

3.3 Charge of the plug register

This register can be charged either manually or automatically. Its logic will be studied in the framework of an adaptation slide where besides the visualization of the level is considered.

4. RAZ

4.1 Object, Principle

At the beginning of counting one anticipates resetting to 0 the false time base.

After the front mounting of the 1.6 Hz one takes the second impulsion of the 645 K Hz which is present and one applies it to RAZ on the reset of the bistables (the timer is then at zero).

4.2 Realization

4.2.1 Table of the phases, diagram of the conditions

4.2.1.1 Diagram

One calls oe the 1.6 Hz, z the outlet of a sequential circuit charged with taking the second impulsion from the 645 K Hz which is present after the 1.6 Hz.

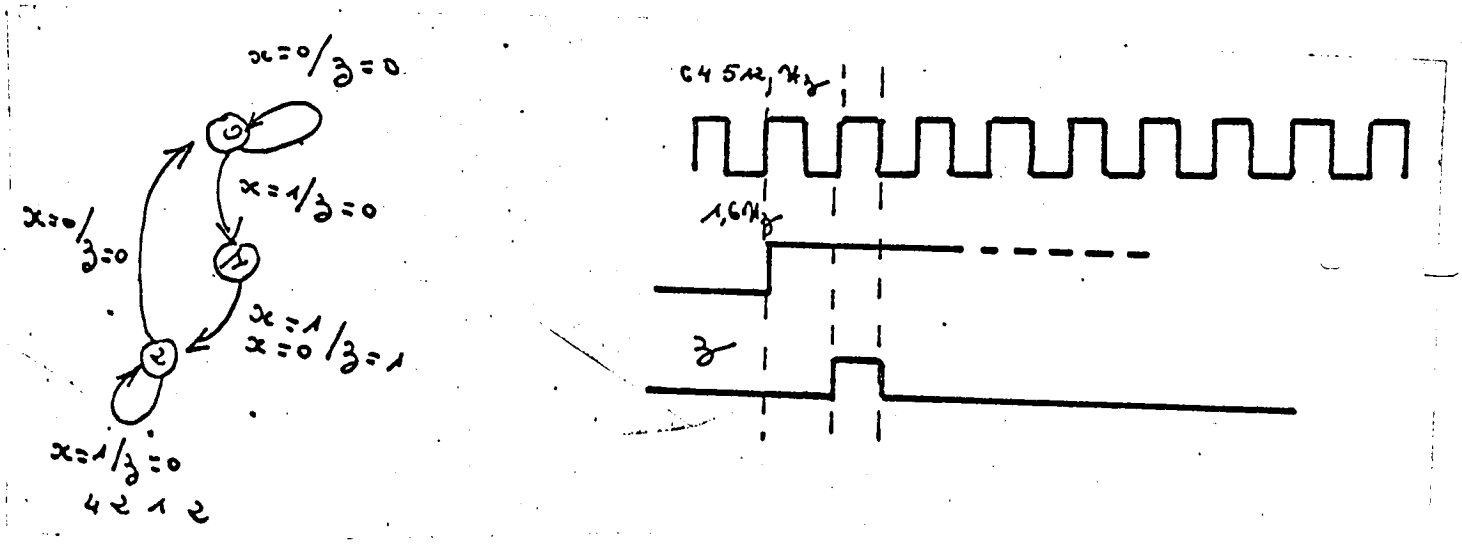
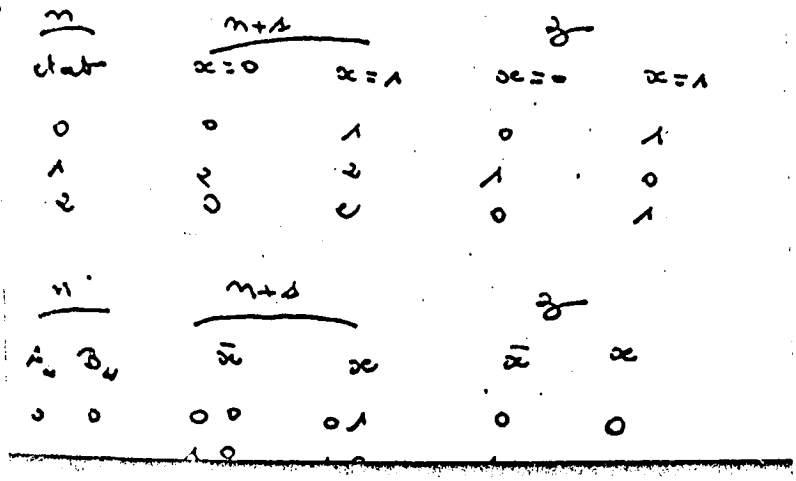


Table of truth



4.2.2 Input equations

	A_4	B_4
J	B_4	$A_4 x$
K	$\bar{x}$	1

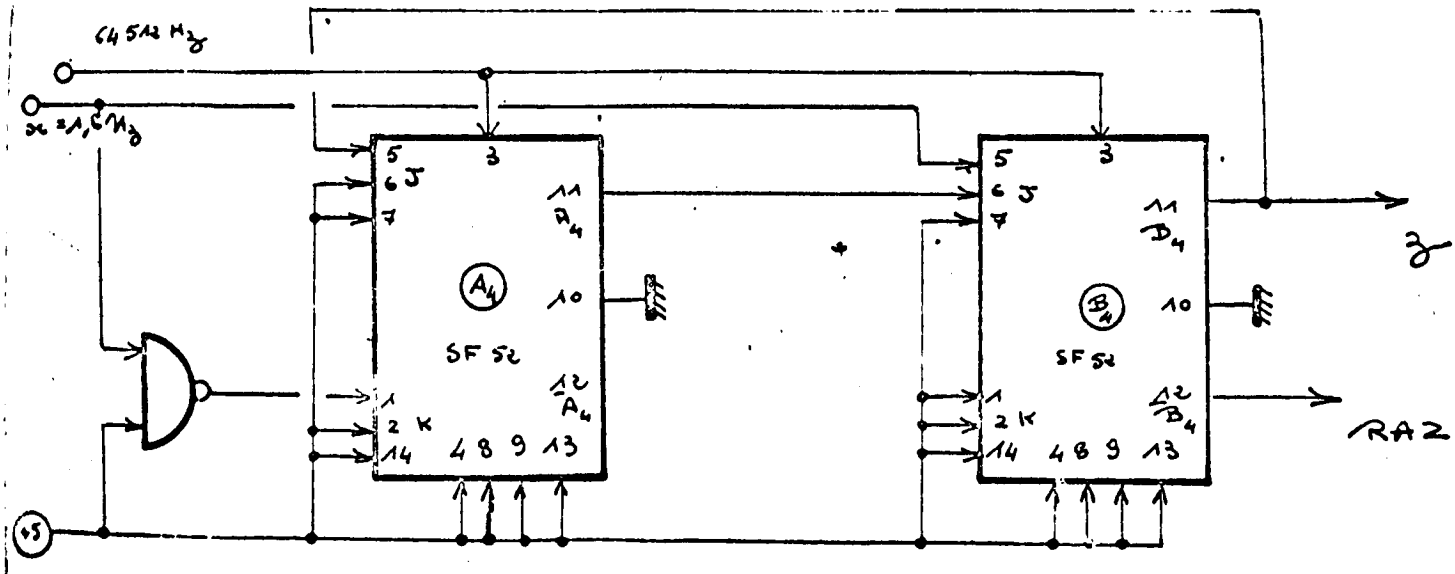
$y = B_4$

Clock clock 64 512 Hz

signal de commande oe = 1,6 Hz

Command signal oe = 1.6 Hz

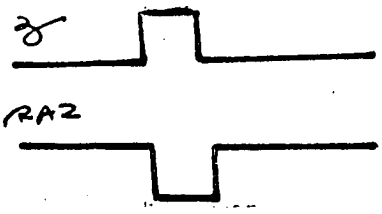
4.2.3 Schema



4.3 Application of the RAZ

One uses therefore a signal z (which is the second impulsion of the 645 K Hz after the front mounting of 1.6 Hz) which one reverses in order to apply on the "reset" of the bistables the level corresponding to a resetting at zero.

RAZ = $\bar{z}$



In the absence of a clock, if one applies on the "set and "reset" inputs the levels "1" and "0" respectively, the bistable passes to zero.

One will take as RAZ the output $\bar{B}_4$.

Remark

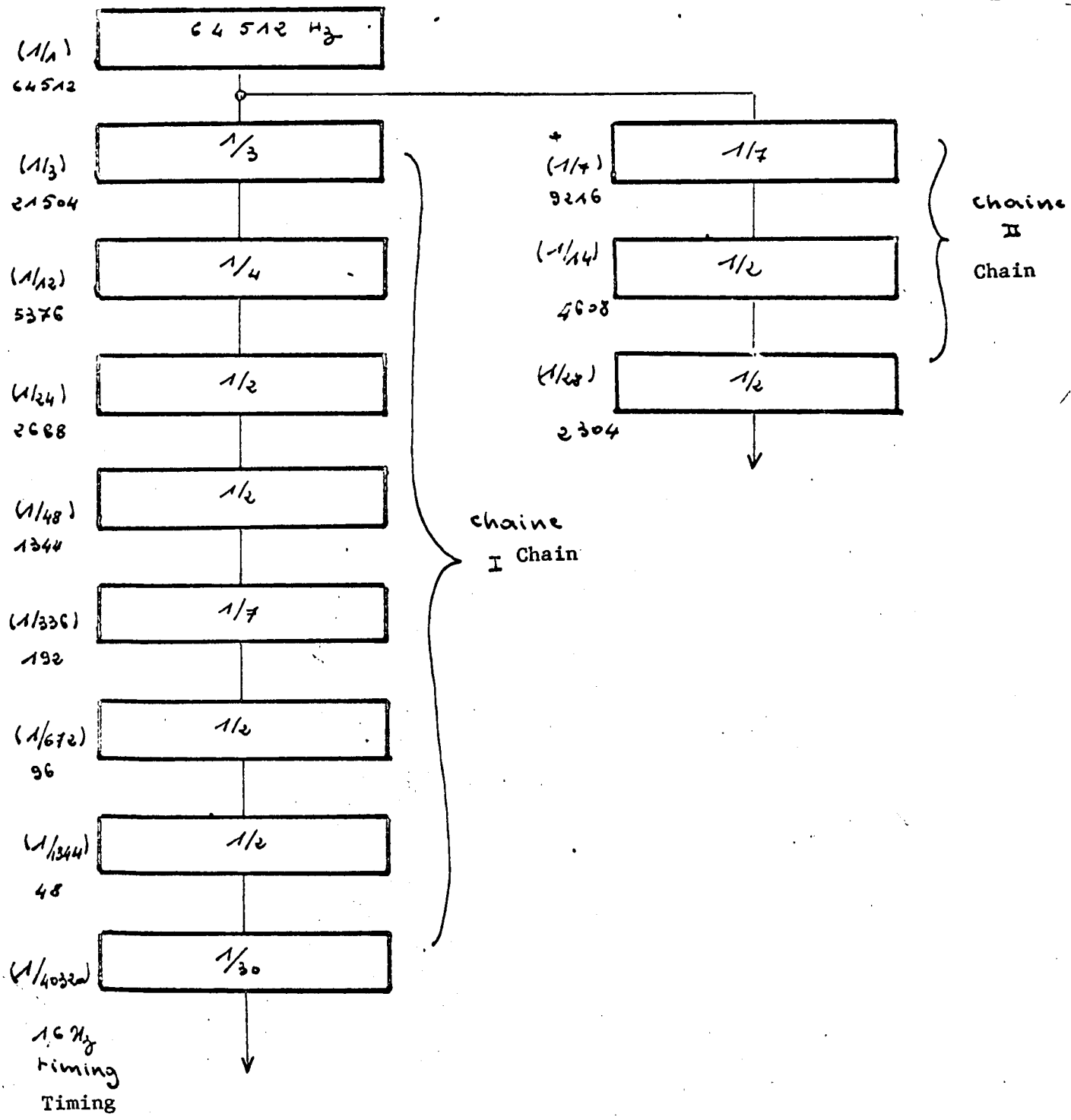
The "reset" entry on the Sylvania SF 52 bistable is found at the pin number 13, one will have the RAZ by cabling the output $\bar{B}_4$ on all number 13 pins of the bistables.

5. False time base

5.1 Goal

The object of this time base is to furnish all the frequencies and the timing neçessary to the sending of balloon information shifted in the time of an interval of time corresponding to the satellite balloon distance simulation.

5.2 Diagram


64 512 Hz
(1/1)
64512
1/3
(1/3)
21504
1/4
(1/12)
5376
1/2
(1/24)
2688
1/2
(1/48)
1344
1/7
(1/336)
192
1/2
(1/672)
96
1/2
(1/1344)
48
1/30
(1/40320)
1,6 Hz
Timing
Timing
chaine
I Chain
1/7
(1/7)
9216
1/2
(1/14)
4608
1/2
(1/28)
2304
chaine
II
Chain

5.3 Chain I

5.3.1 Diviser 1/3 (645 K Hz - 21504 Hz)

5.3.1.1 Table of truth - input equations

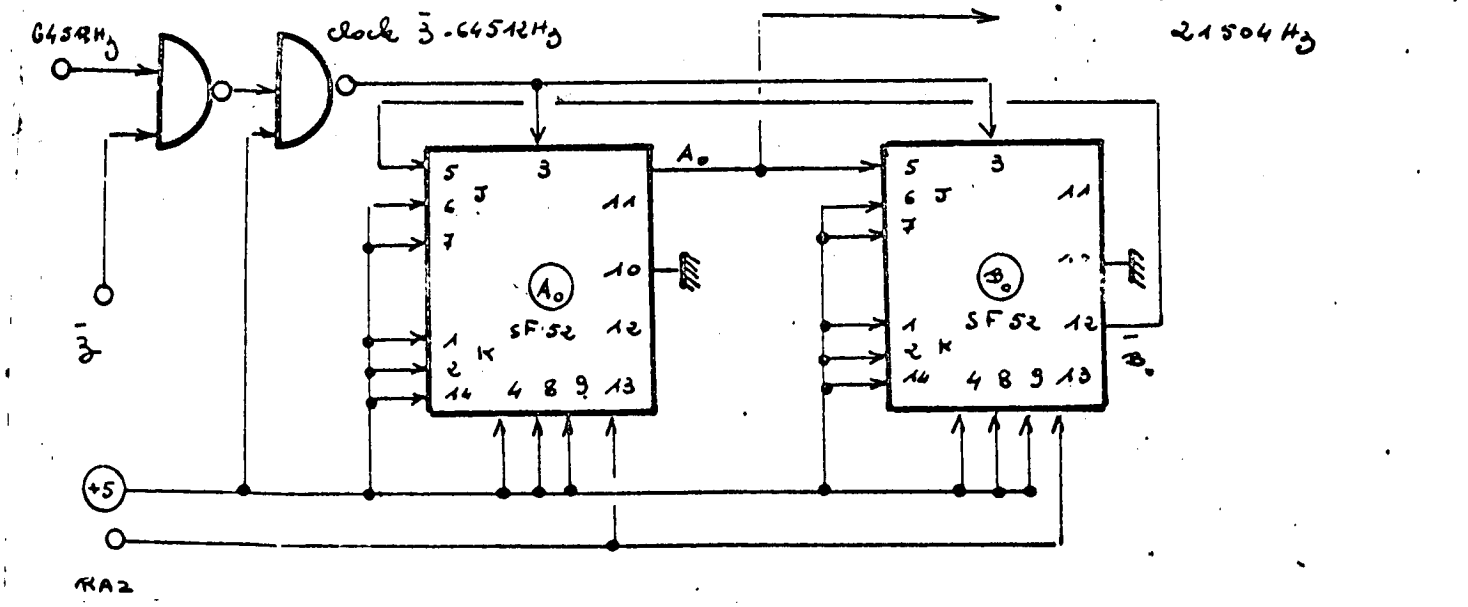
n		$n+1$	
A_0	B_0	A_0	B_0
0	0	0	1
0	1	1	0
1	0	0	0

	A_0	B_0
J	$\bar{B}_0$	A_0
K	1	1

Clock clock $\bar{3}$. 64512 Hz

Output sortie 21504 Hz (A_0)

5.3.1.2 Schema



5.3.2 Diviser 1/4 (21504 Hz - 5376 Hz)

5.3.2.1 Table of truth - input equations

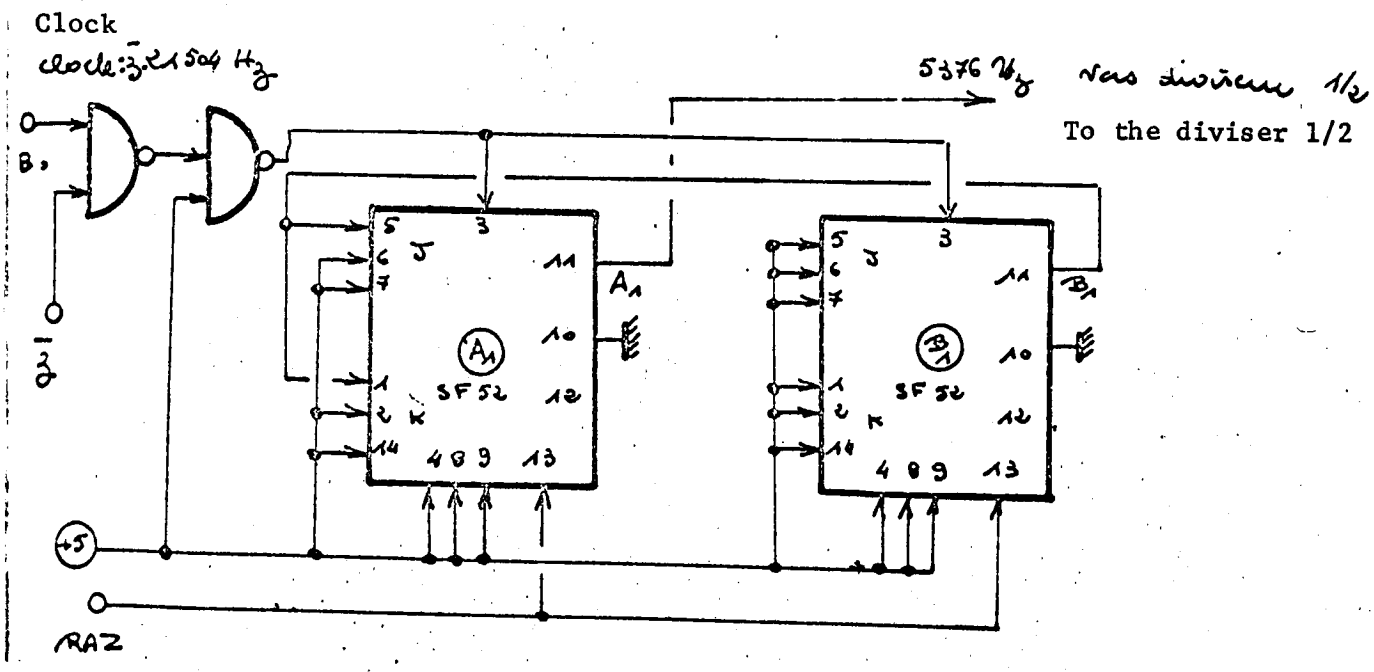
n		$n+1$	
A_1	B_1	A_1	B_1
0	0	0	1
0	1	1	0
1	0	1	1
1	1	0	0

	A_1	B_1
J	B_1	1
K	B_1	1

Clock clock $\bar{J}$. 21504 Hz (A_0)

Output sortie (A_1) 5376 Hz

5.3.2.2 Schema



5.3.3 Diviser by 2 (5376 Hz - 4688 Hz)

5.3.3.1 Table of truth - input equations

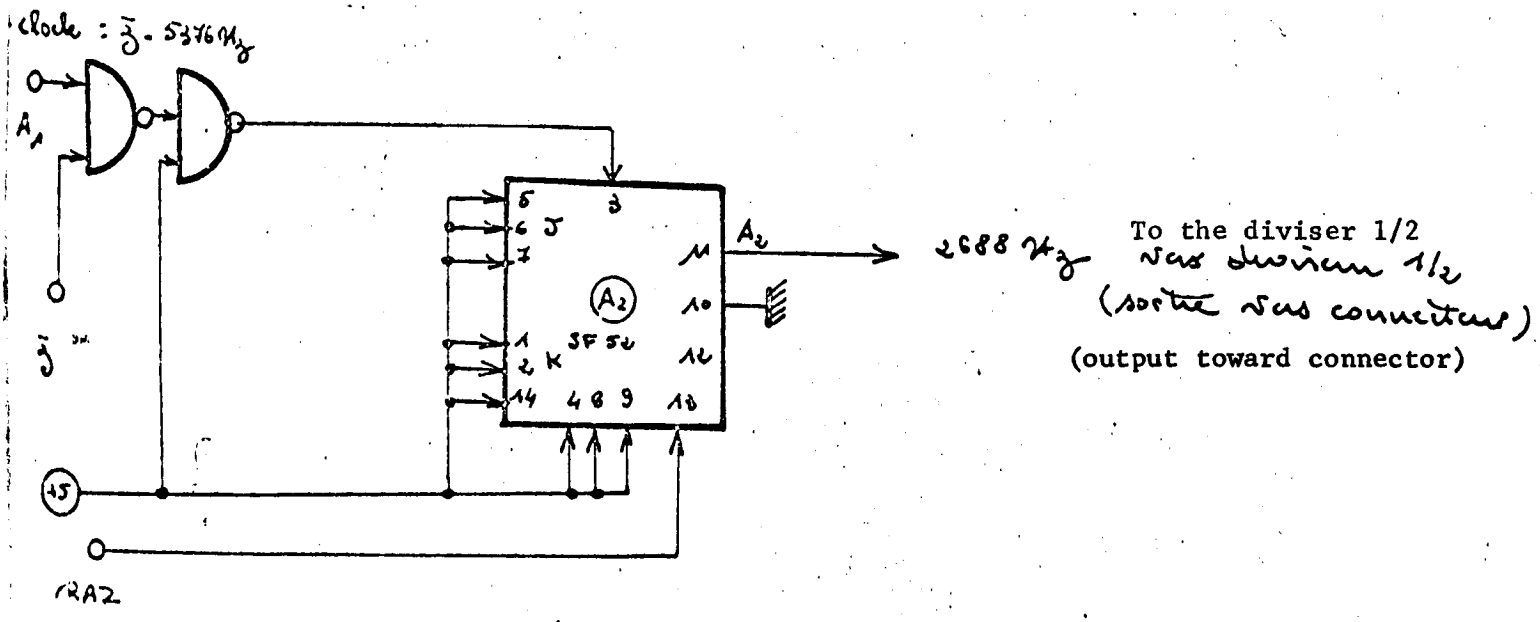
n	$n+1$
A_2	A_2
0	1
1	0

	A_2
J	1
K	1

Clock clock: J̄. 5376 Hz (A_1)

Output sortie A_2 2688 Hz

5.3.3.2 Schema

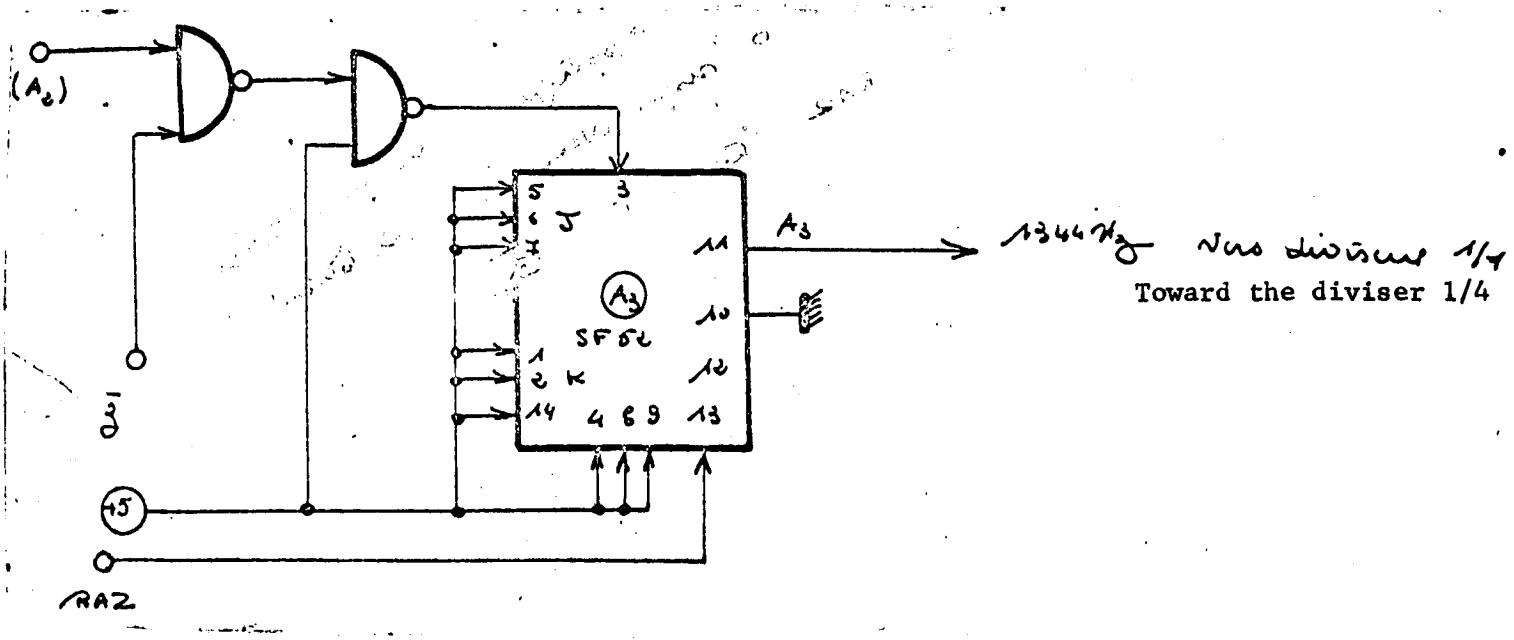


5.3.4 Diviser by 2 (2688 Hz - 1344 Hz)

5.3.4.1 Input equations

	A3
J.	1

Clock clock $\bar{J}$. 2688 Hz
Output sortie 1344 Hz A3



5.3.5 Diviser by 7 (1344 Hz - 192 Hz)

5.3.5.1 Table of truth - input equations

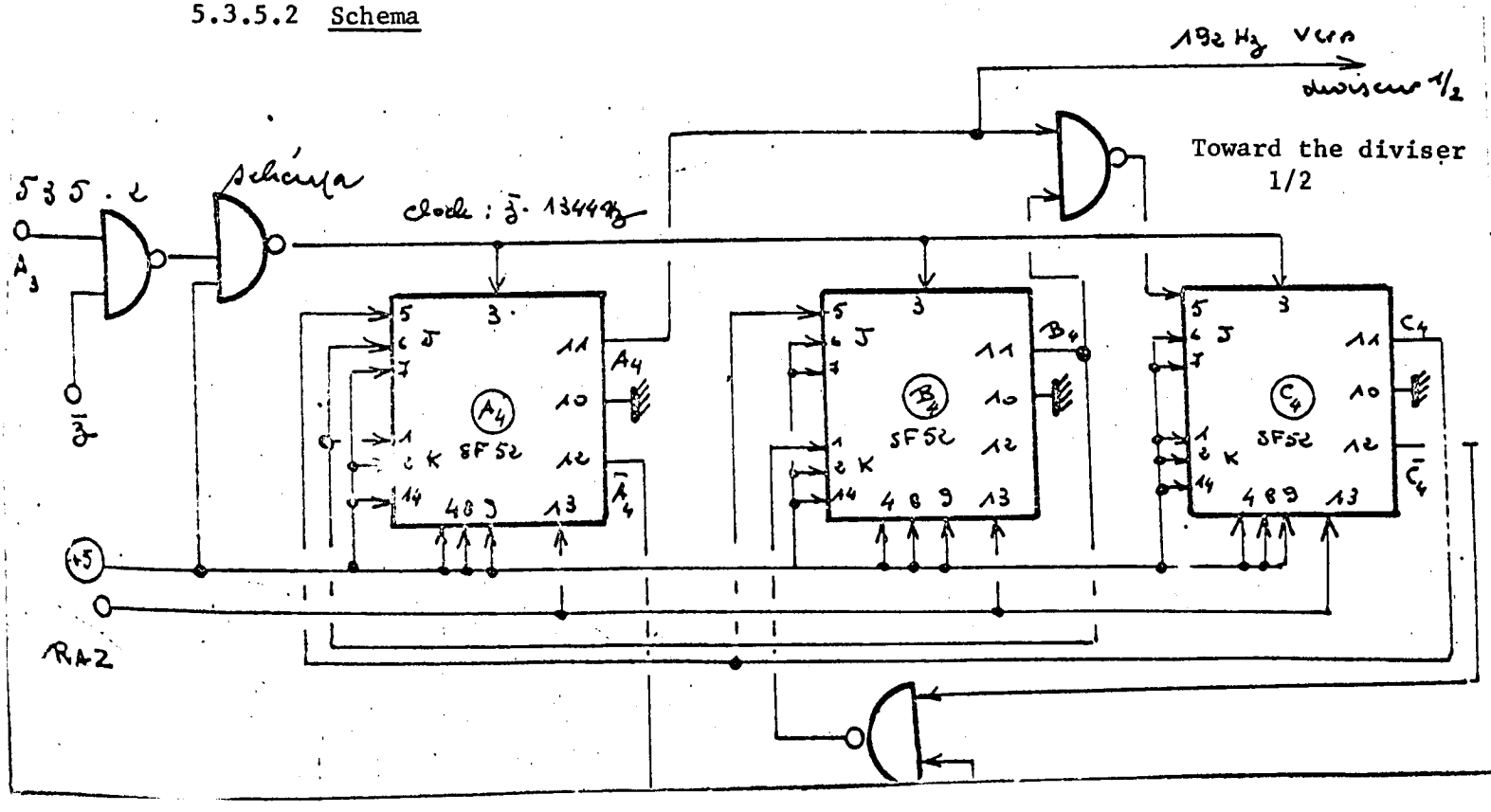
$A_n B_n C_n$	$A_{n+1} B_{n+1} C_{n+1}$
0 0 0	0 0 1
0 0 1	0 1 0
0 1 0	0 1 1
0 1 1	1 0 0
1 0 0	1 0 1
1 0 1	1 1 0
1 1 0	0 0 0

	A_4	B_4	C_4
J	$B_4 C_4$	C_4	$\bar{A}_4 + \bar{B}_4$
K	B_4	$A_4 + C_4$	1

Clock clock : $\bar{J}$ · 1344 Hz

Output/sortie 192 Hz A_4

5.3.5.2 Schema



5.3.6 Diviser by 2 (192 Hz - 96 Hz)

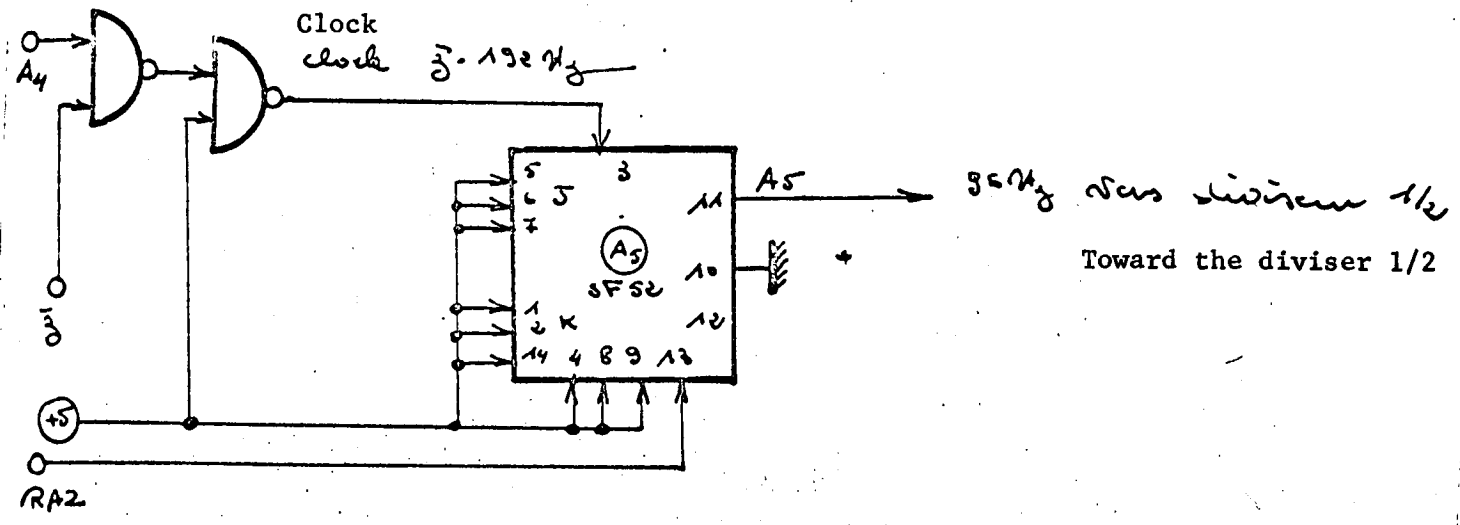
5.3.6.1 Input equations

	A_5
J	1
K	1

Clock clock $\bar{3}$. 192 Hz

Output sortie 96 Hz A_5

5.3.6.2 Schema



5.3.7 Diviser by 2 (96 Hz - 48 Hz)

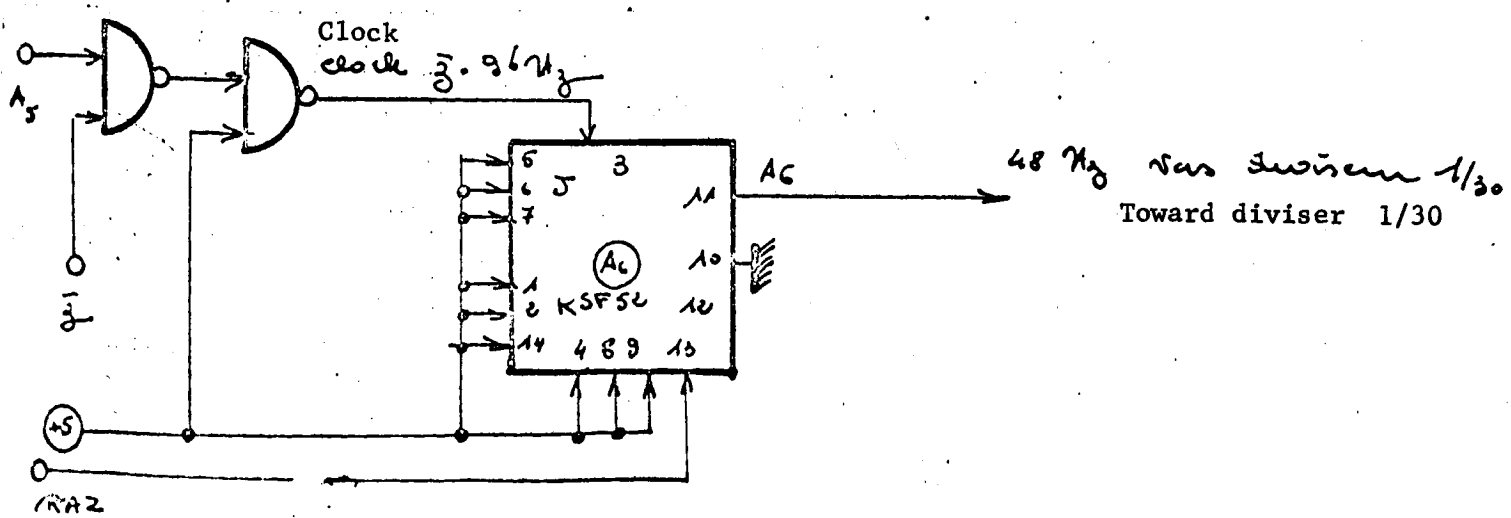
5.3.7.1 Input equations

	A_6
J	1
K	1

Clock clock $\bar{3}$. 96 Hz

Output sortie 48 Hz A_6

5.3.7.2 Schema



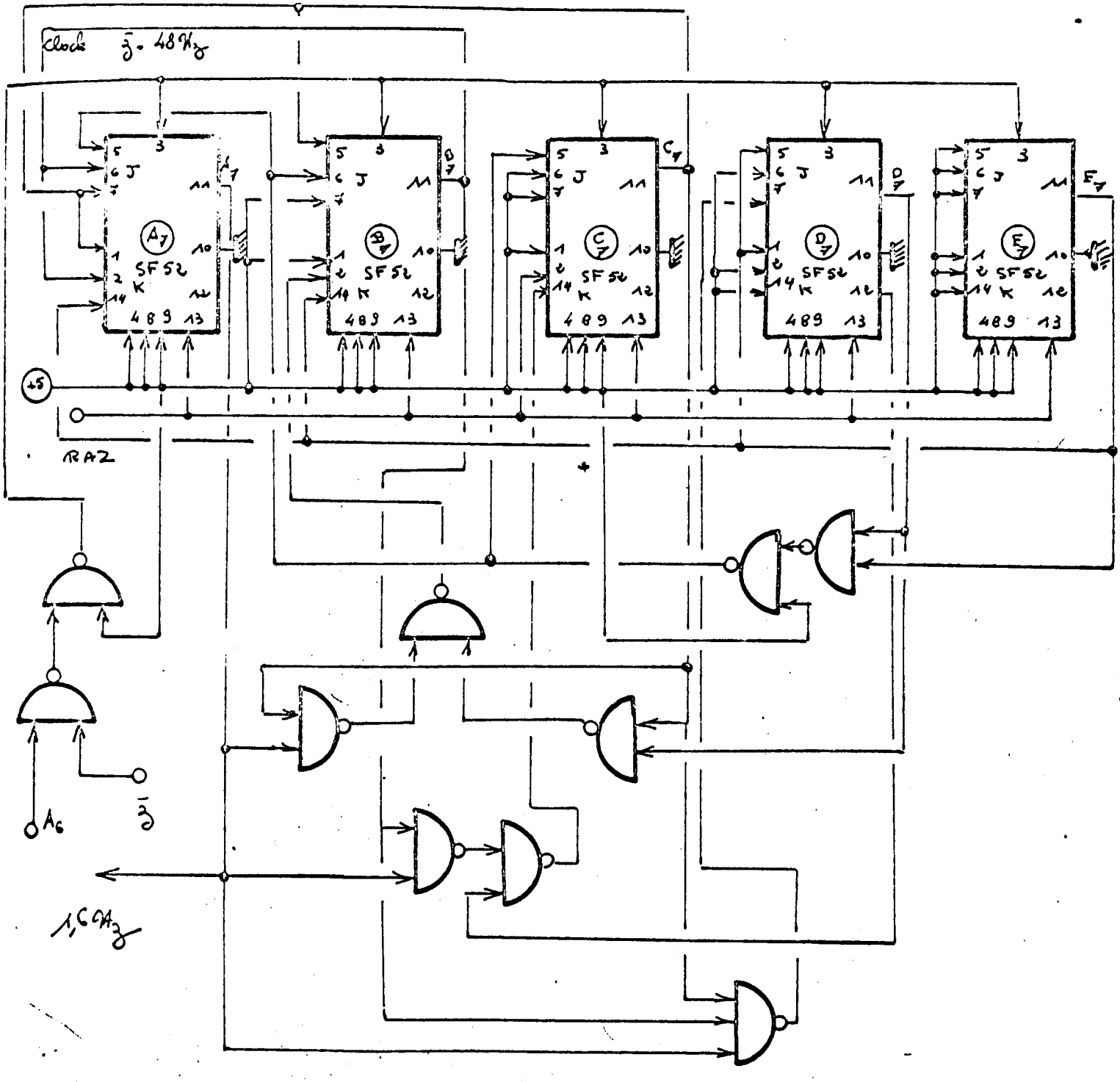
5.3.8 Diviser by 30 (48 Hz - 160 Hz)

5.3.8.1 Table of truth - input equations

	n					n+1				
	A_n	B_n	C_n	D_n	E_n	A_{n+1}	B_{n+1}	C_{n+1}	D_{n+1}	E_{n+1}
t_0	0	0	0	0	0	0	0	0	0	1
t_1	0	0	0	0	1	0	0	0	1	0
t_2	0	0	0	1	0	0	0	0	1	1
t_3	0	0	0	1	1	0	0	1	0	0
t_4	0	0	1	0	0	0	0	1	0	1
t_5	0	0	1	0	1	0	0	1	1	0
t_6	0	0	1	1	0	0	0	1	1	1
t_7	0	0	1	1	1	0	1	0	0	0
t_8	0	1	0	0	0	0	1	0	0	1
t_9	0	1	0	0	1	0	1	0	1	0
t_{10}	0	1	0	1	0	0	1	0	1	1
t_{11}	0	1	0	1	1	0	1	1	0	0
t_{12}	0	1	1	0	0	0	1	1	0	1
t_{13}	0	1	1	0	1	0	1	1	1	0
t_{14}	0	1	1	1	0	0	1	1	1	1
t_{15}	0	1	1	1	1	1	0	0	0	0
t_{16}	1	0	0	0	0	1	0	0	0	1
t_{17}	1	0	0	0	1	1	0	0	1	0
t_{18}	1	0	0	1	0	1	0	0	1	1
t_{19}	1	0	0	1	1	1	0	1	0	0
t_{20}	1	0	1	0	0	1	0	1	0	1
t_{21}	1	0	1	0	1	1	0	1	1	0
t_{22}	1	0	1	1	0	1	0	1	1	1
t_{23}	1	0	1	1	1	1	1	0	0	0
t_{24}	1	1	0	0	0	1	1	0	0	1
t_{25}	1	1	0	0	1	1	1	0	1	0
t_{26}	1	1	0	1	0	1	1	0	1	1
t_{27}	1	1	0	1	1	1	1	1	0	0
t_{28}	1	1	1	0	0	1	1	1	0	1
t_{29}	1	1	1	0	1	0	0	0	0	0

	A_n	B_n	C_n	D_n	E_n
J	$BCDE$	CDE	DE	$E(\bar{A}+\bar{B}+\bar{C})$	1

5.3.8.2 Schema



5.4 Chain II

5.4.1 Diviser 1/7 (645 K Hz - 9216 Hz)

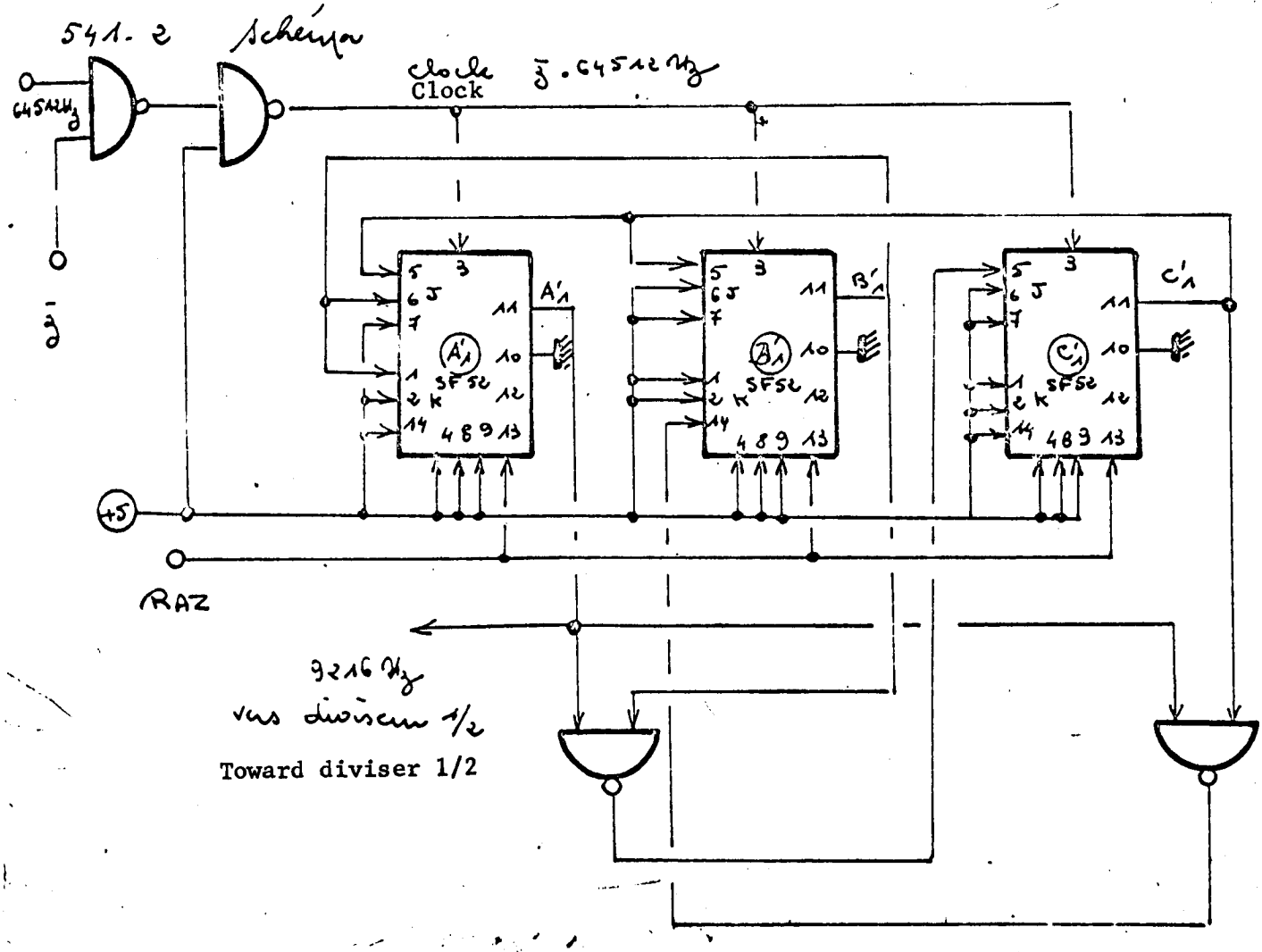
5.4.1.1 Input equations

	A'_1	B'_1	C'_1
J	$\bar{B}'_1 C'_1$	C'_1	$\bar{A}'_1 + \bar{B}'_1$
K	B'_1	$A'_1 + C'_1$	1

Clock clock $\bar{J}$. 645 12 Hz

Output Sortie 9216 Hz . A'_1

5.4.1.2 Schema



5.4.2 Diviser 1/2 (9216 Hz - 4608 Hz)

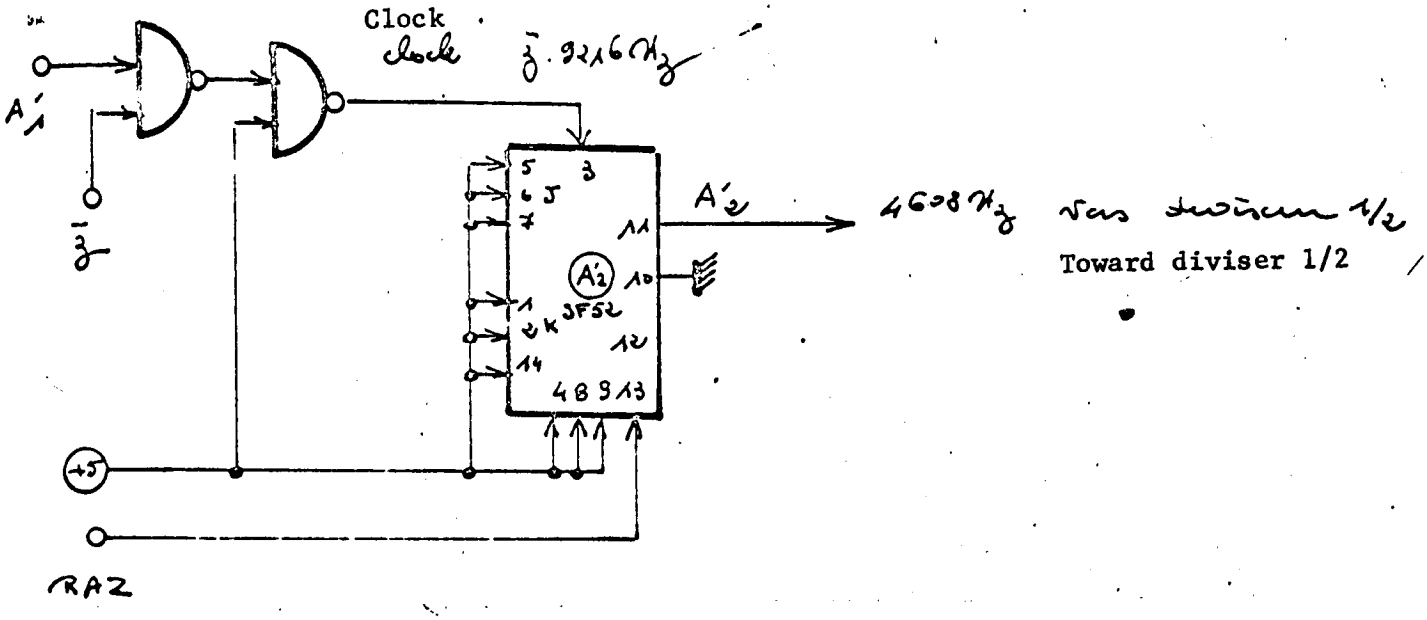
5.4.2.1 Input equations

	A'_2
J	1
K	1

Clock clock $\bar{3}$ · 9216 Hz

Output sortie 4608 Hz A'_2

5.4.2.2 Schema



5.4.3 Diviser by 2 (4608 Hz - 2304 Hz)

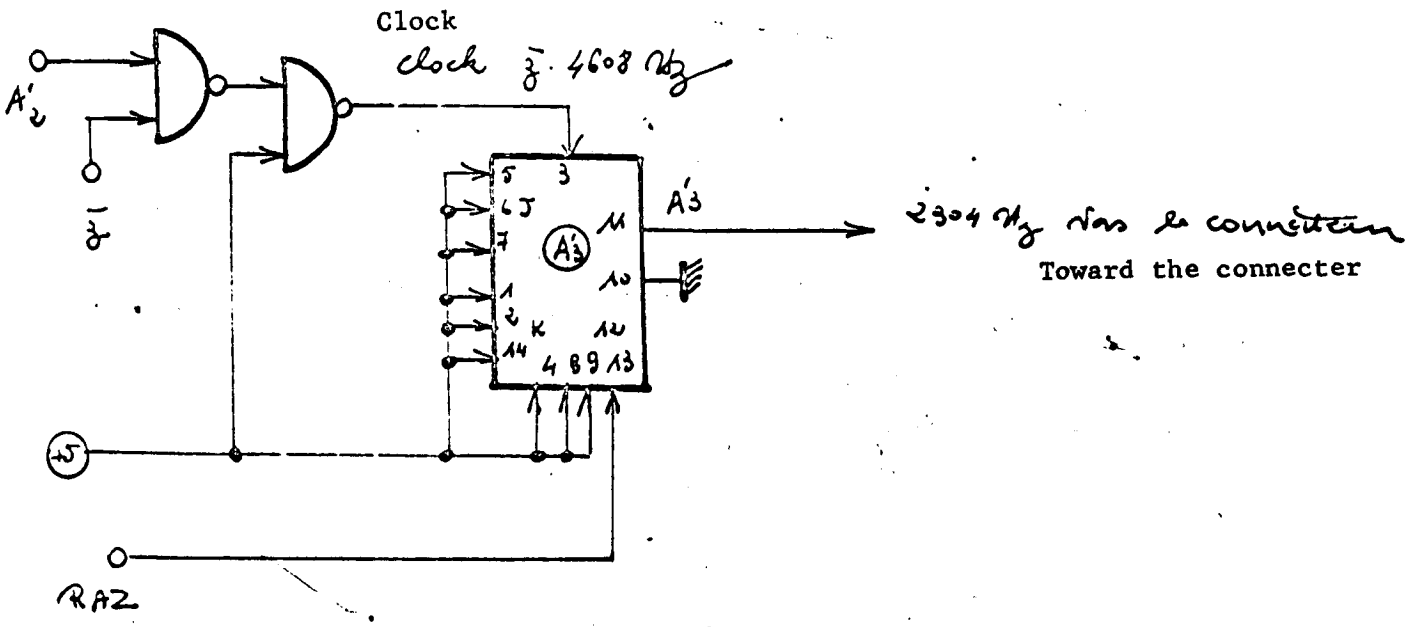
5.4.3.1 Input equations

	A'_3
J	1
K	1

Clock clock $\bar{3}$ · 4608 Hz

Output sortie 2304 Hz A'_3

5.4.3.2 Schema



Remark

The course of integration in order to assure the distance simulation two frequencies come from the satellite:

1) 1.6 Hz which releases the simulation (beginning of counting).

2) 645 K Hz which attacks the division chains.

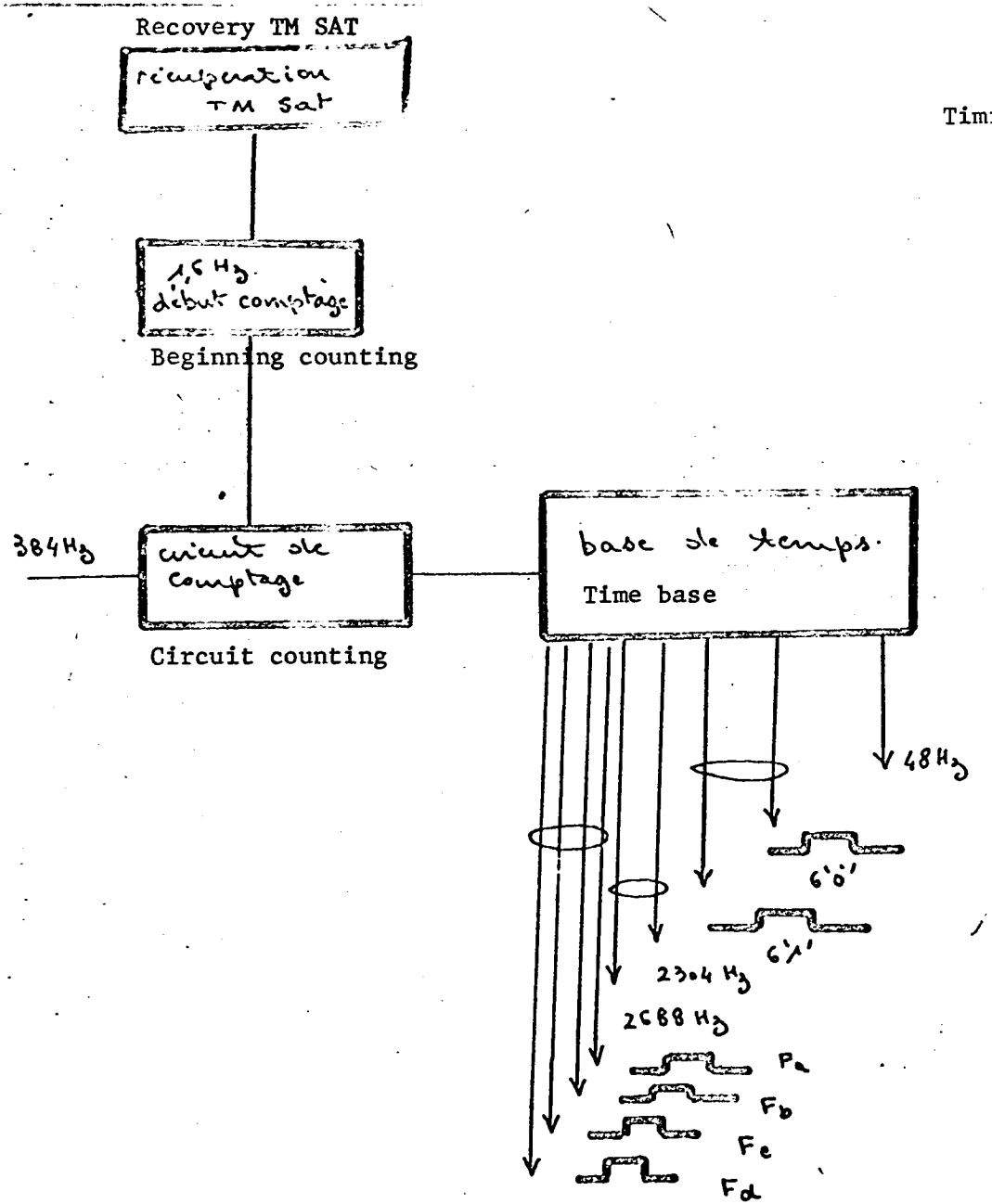
The 1.6 Hz is obtained by decommutation of a word of the format of TMS.

The 645 K Hz is qbtained in two ways

a) From the satellite by a coaxial (word unreadable) connection.

b) From a 645 K Hz oscillator. (The schema of the oscillator is indicated in the VEO slide.)

Timing of the distance slide

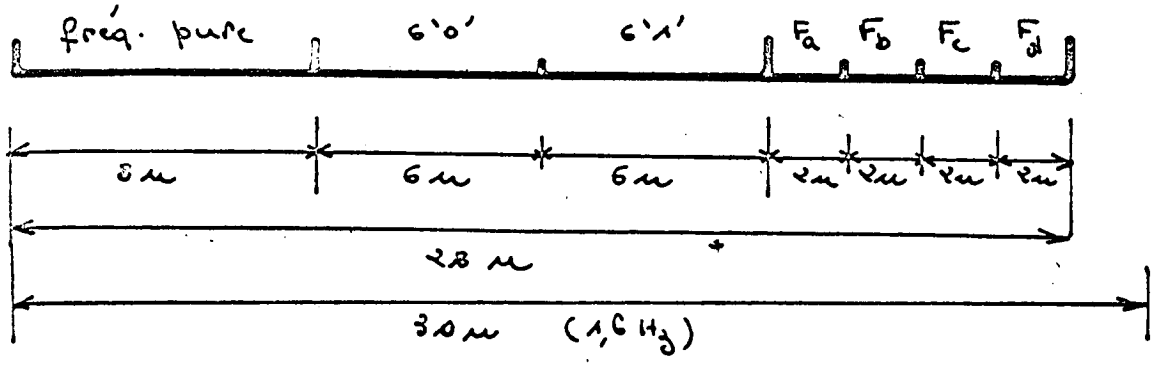


6. Timing of the balloon answer

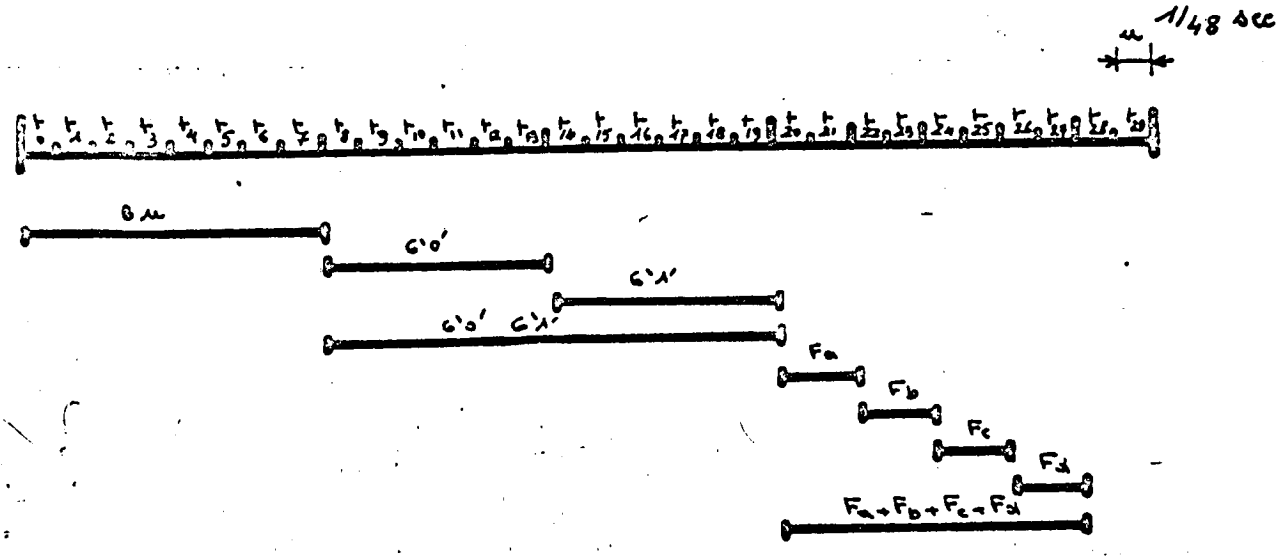
6.1 Calls

The balloon answer in the EOLE system is constituted as is indicated below:

Pure frequency



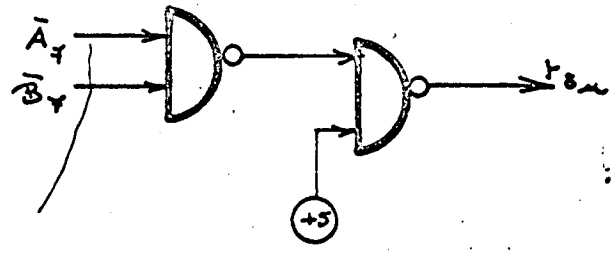
The 6'0' 6'1' of the balloon ought to be fixed on the 6'0' 6'1' of the satellite (call sequence). The reajustment will be realized by decommutation of a TMS format placement which will serve as "top" 1.6 Hz which disconnects the false time base.



6.2 Realization of the "timing"

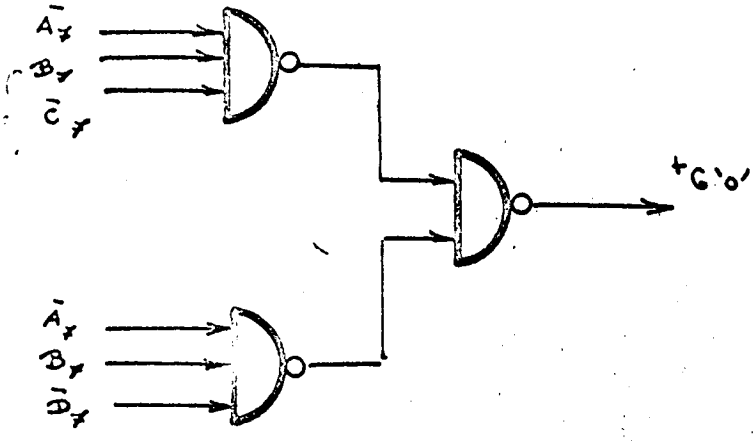
6.2.1 Timing 8 u

$$t_{8u} = t_0 + t_1 + t_2 + t_3 + t_4 + t_5 + t_6 + t_7 = \bar{A}_7 \bar{B}_7$$



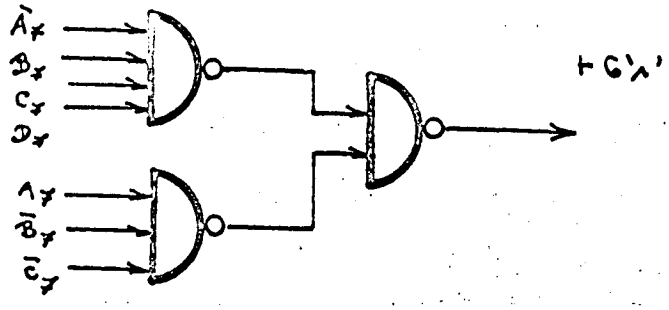
6.2.2 Timing 6'0', 6'1'

6.2.2.1 Timing 6'0'



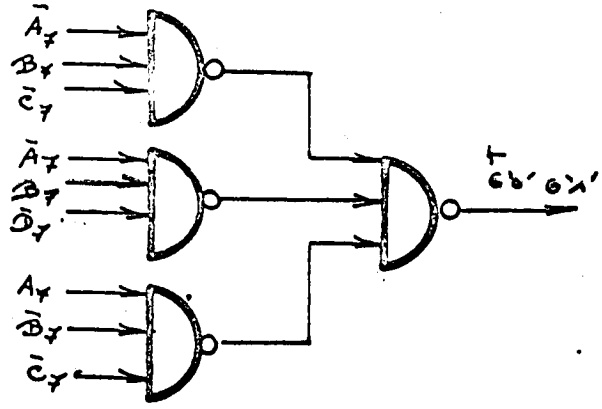
6.2.2-2 $t_{C'1'}$

$$t_{C'1'} = t_{14} + t_{15} + t_{16} + t_{17} + t_{18} + t_{19} = \bar{A}_7 B_7 C_7 D_7 + A_7 \bar{B}_7 \bar{C}_7$$



6.2.2-3 $\vdash_{G'0'\ G'1'}$

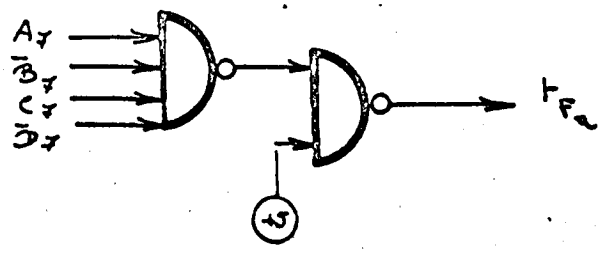
$$\vdash_{G'0'\ G'1'} = \vdash_{G'0'} + \vdash_{G'1'} = \bar{A}_7 B_7 \bar{C}_7 + \bar{A}_7 B_7 \bar{D}_7 + A_7 \bar{B}_7 \bar{C}_7$$



6.2.3 Timing HK F_a, F_b, F_c, F_d

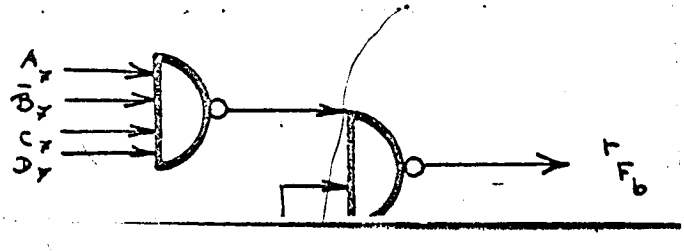
6.2.3.1 $\vdash_{F_a}$

$$\vdash_{F_a} = \vdash_{20} + \vdash_{21} = A_7 \bar{B}_7 C_7 \bar{D}_7$$



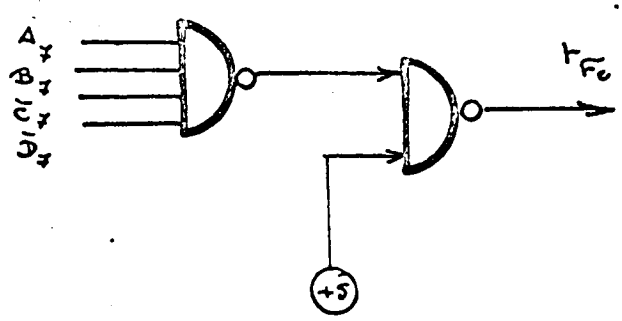
6.2.3.2 $\vdash_{F_b}$

$$\vdash_{F_b} = \vdash_{22} + \vdash_{23} = A_7 \bar{B}_7 C_7 D_7$$



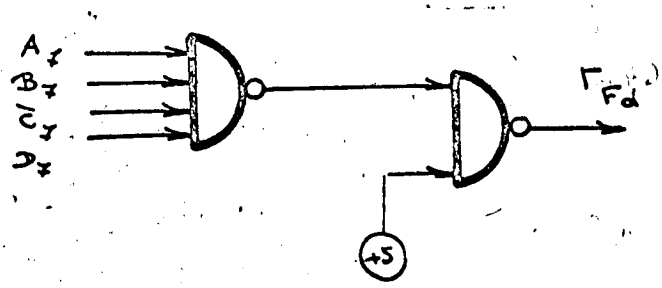
6.2.3.3 Γ_{F_c}

$\Gamma_{F_c} = \Gamma_{24} \cdot \Gamma_{25} = A_{\Gamma} B_{\Gamma} \bar{C}_{\Gamma} \bar{D}_{\Gamma}$



6.2.3.4 Γ_{F_d}

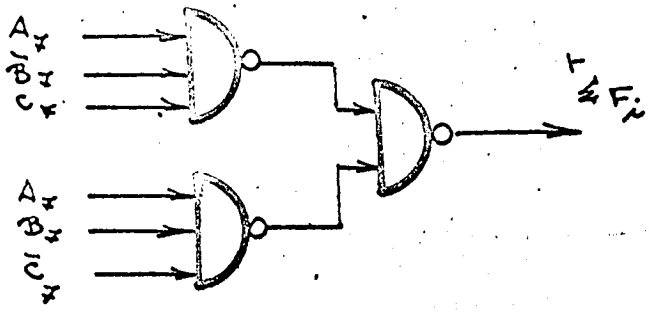
$\Gamma_{F_d} = \Gamma_{26} \cdot \Gamma_{27} = A_{\Gamma} B_{\Gamma} \bar{C}_{\Gamma} D_{\Gamma}$



6.2.3.5

$\Gamma_{F_a} \cdot \Gamma_{F_b} \cdot \Gamma_{F_c} \cdot \Gamma_{F_d}$

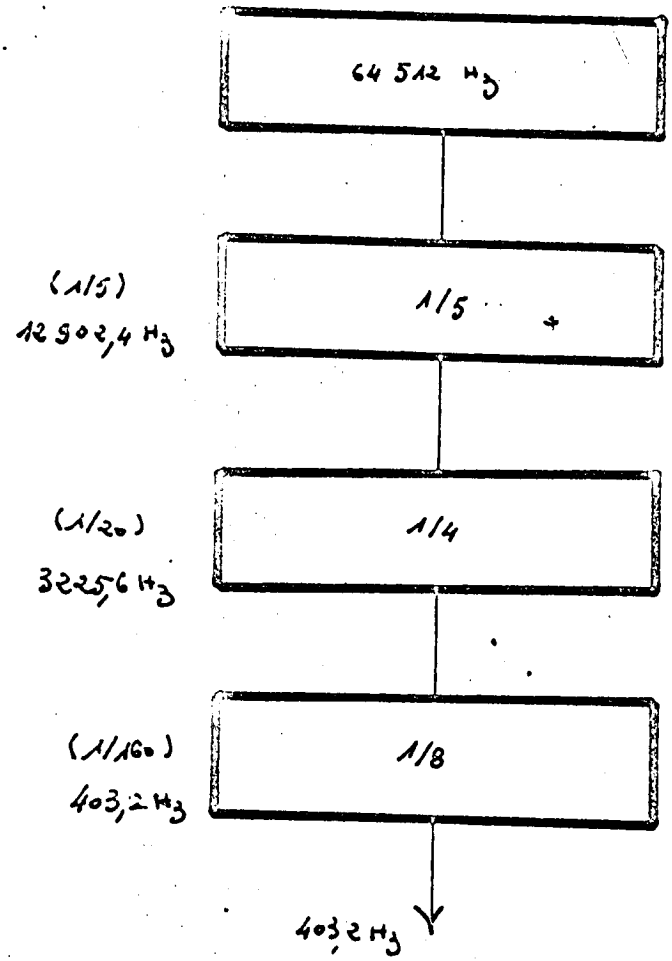
$\Gamma_{\Sigma F_i} = \Gamma_{F_a} \cdot \Gamma_{F_b} \cdot \Gamma_{F_c} \cdot \Gamma_{F_d} = A_{\Gamma} \bar{B}_{\Gamma} C_{\Gamma} + A_{\Gamma} B_{\Gamma} \bar{C}_{\Gamma}$



7. Frequency of counting

7.1 Diagram

The frequency 403.2 Hz is obtained beginning from 645 K Hz.



7.2 Realization

7.2.1 Diviser by 5 (645 K Hz - 12902.4 Hz)

7.2.1.1 Table of truth, equations

n			$n+1$		
A_0	B_0	C_0	A_0	B_0	C_0
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	0	0	0

$$A_{0\,n+1} = \bar{A}_0 B_0 C_0$$

$$B_{0\,n+1} = \bar{A}_0 (\bar{B}_0 C_0 + B_0 \bar{C}_0)$$

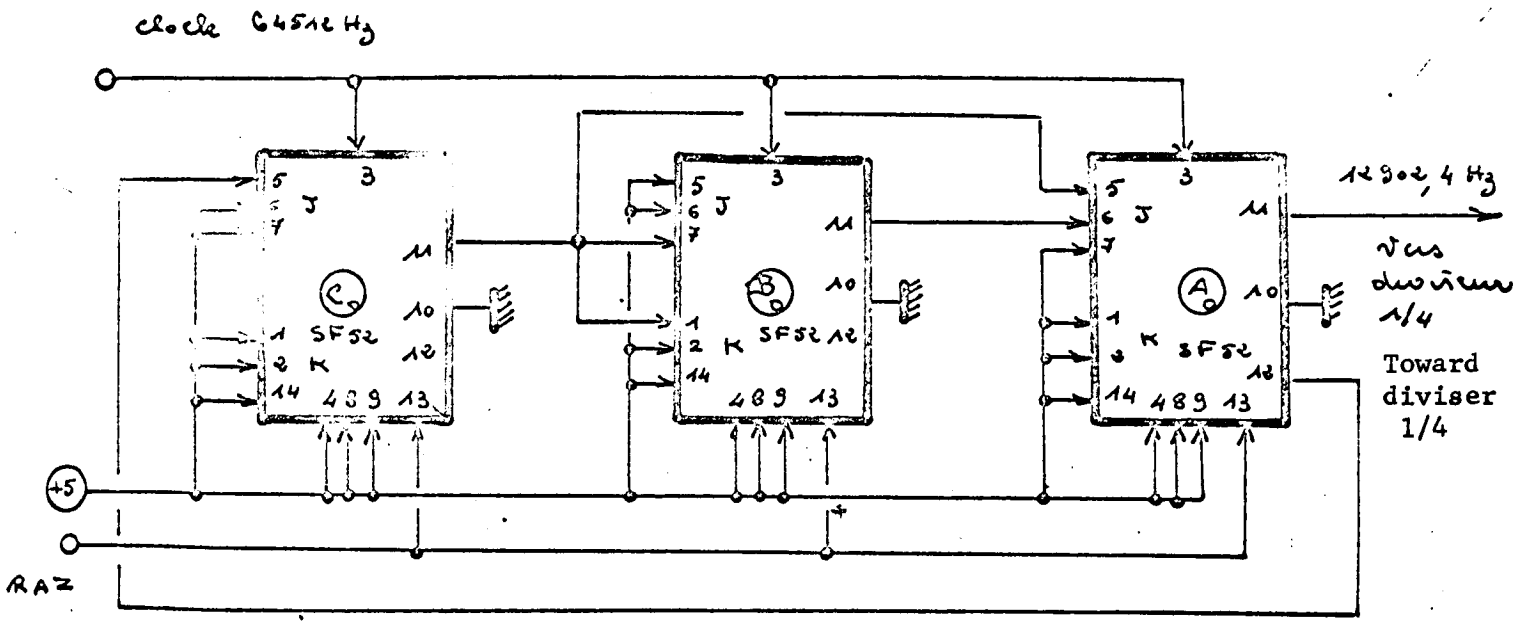
$$C_{0\,n+1} = \bar{A}_0 \bar{C}_0$$

	A_0	B_0	C_0
J	$B_0 C_0$	C_0	$\bar{A}_0$
	1	C_0	1

Clock clock 64512 Hz

Output sortie 12902,4 Hz (A_0)

7.2.1.2 Schema



7.2.2 Diviser by 4 (12902.4 Hz - 3225.6 Hz) 1/4 = 1/2 + 1/2

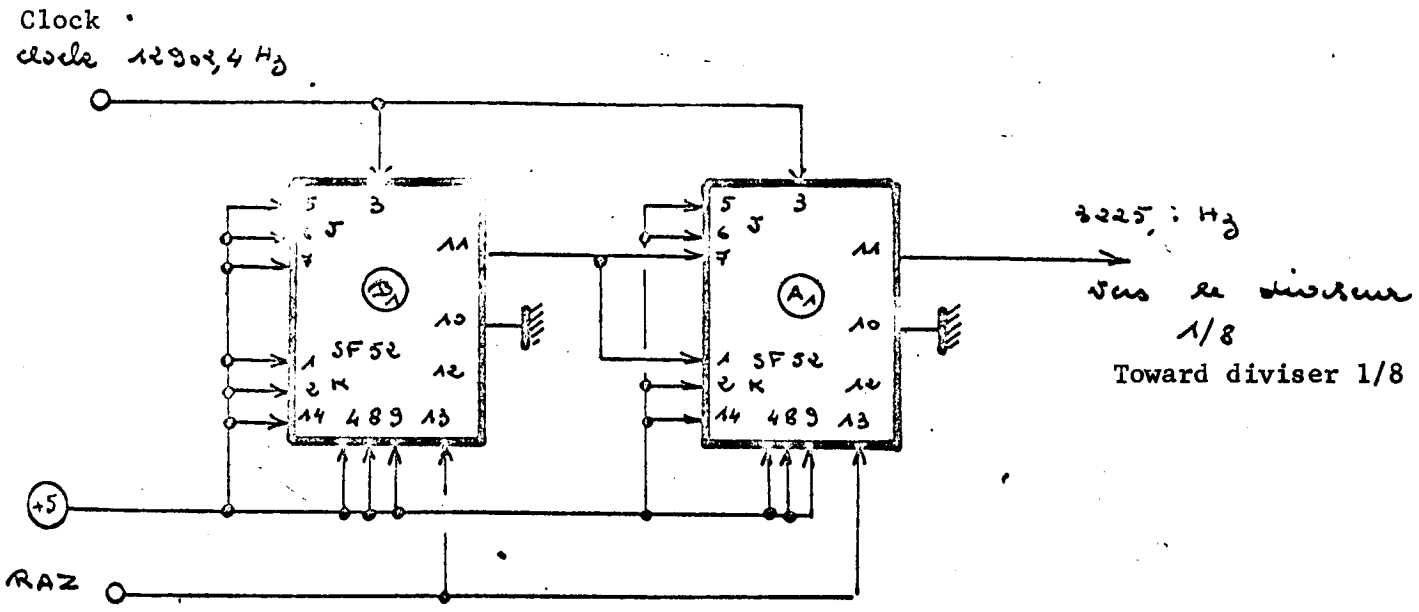
7.2.2.1 Equations

	A_1	B_1
J	B_1	1
K	B_1	1

Clock clock 12902,4 Hz

Output sortie 3225,6 Hz (A_1)

7.2.2.2 Schema



7.2.3 Diviser by 8 (3225.6 Hz - 403.2 Hz) 1/8 = ½ + ½ + ½

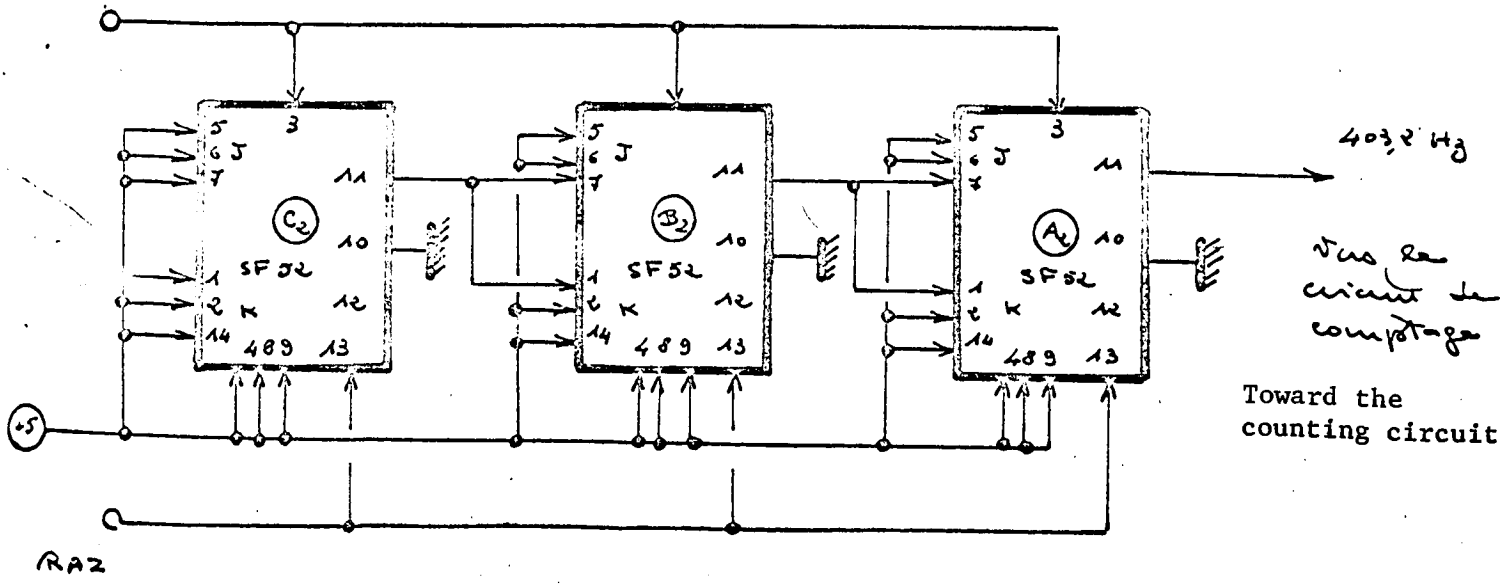
7.2.3.1 Equations

	A_2	B_2	C_2
J	B_2	C_2	1
K	B_2	C_2	1

Clock clock 3225,6 Hz

Output sortie 403,2 Hz (A_2)

7.2.3.2 Schema

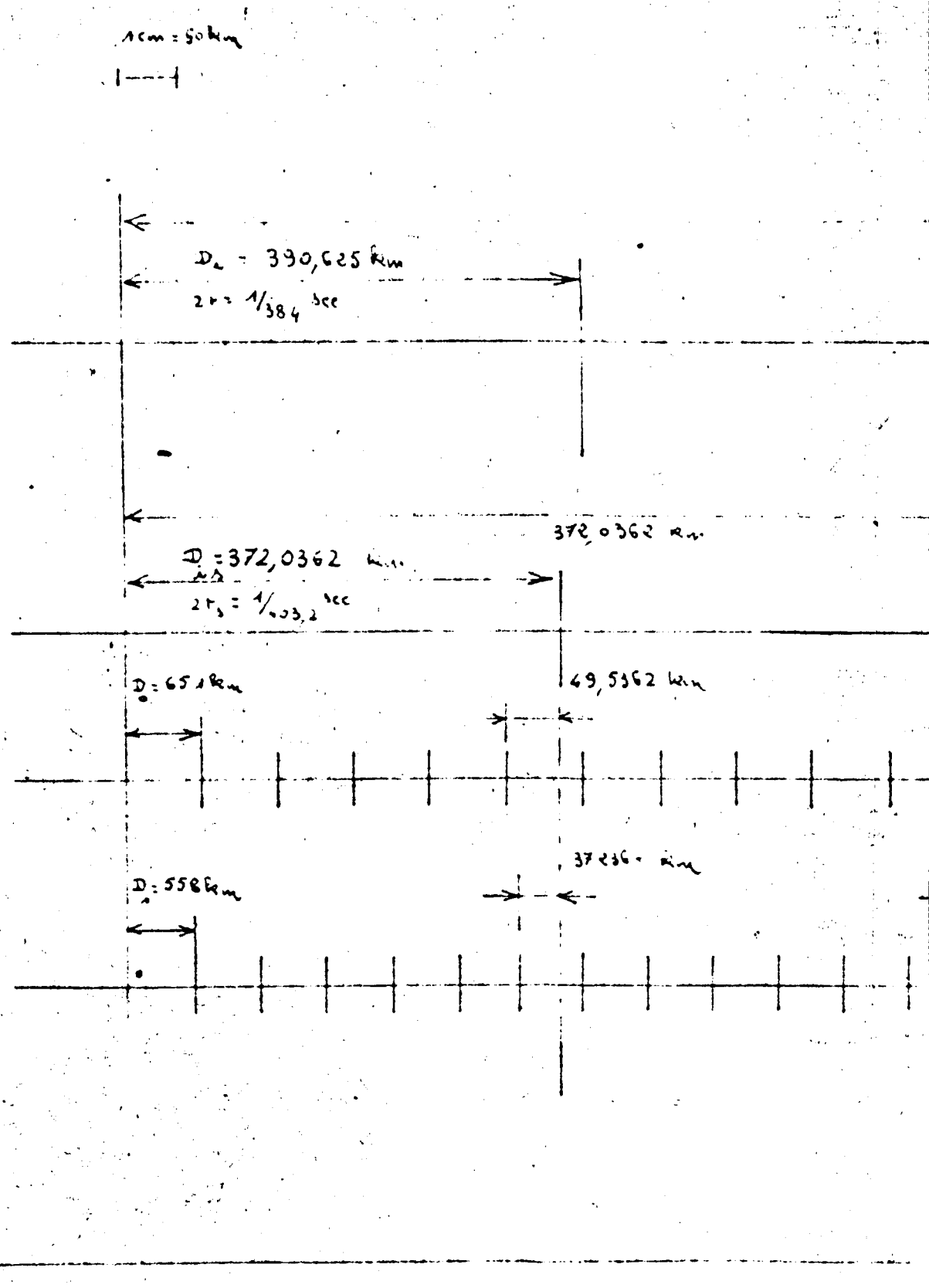


8. Levels of simulation

The whole realized permits making the distance vary in eight levels numbered from one to eight.

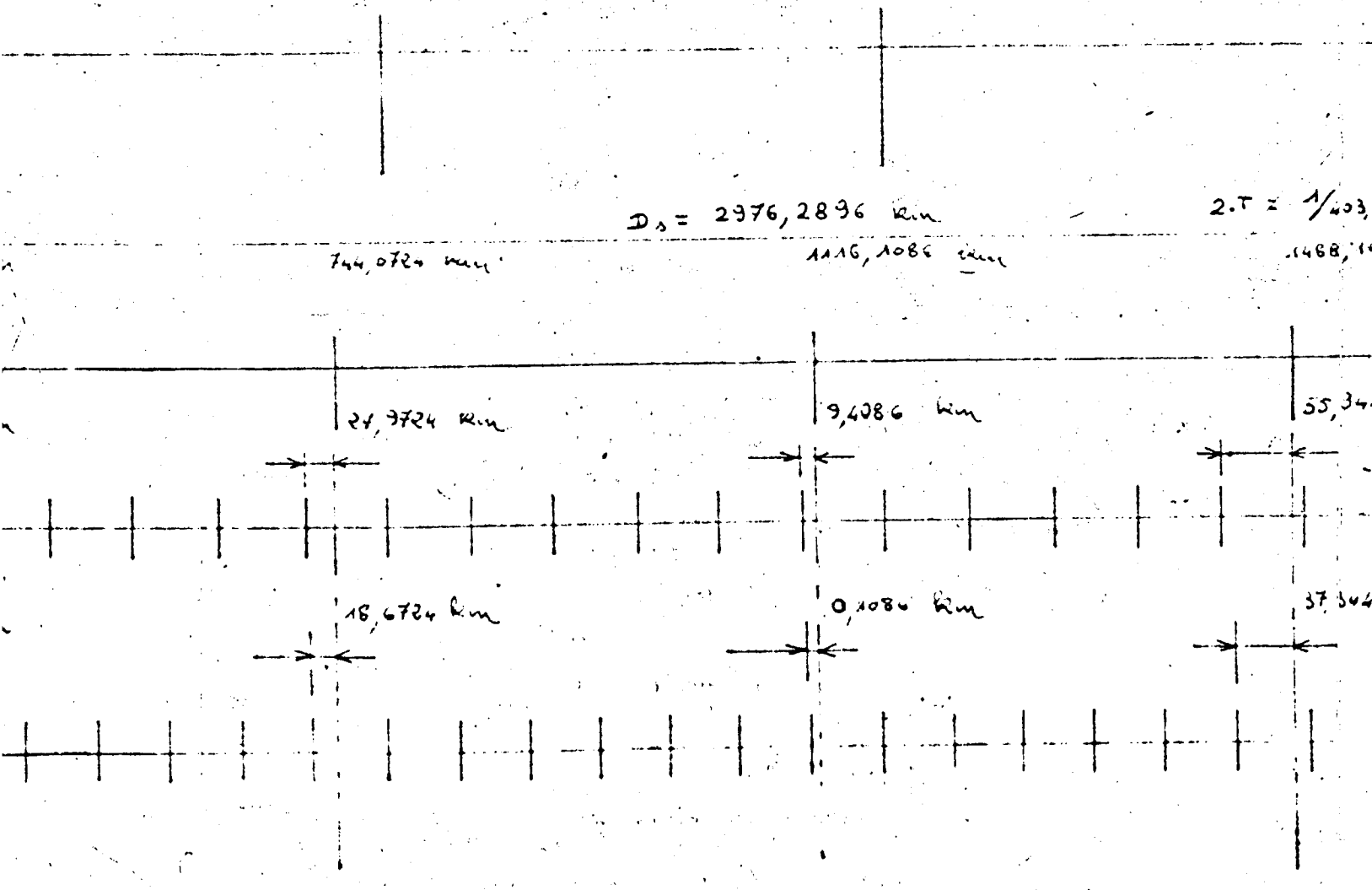
The level number 1 corresponds to a distance of 372.036 km. The step of variation is 372.036 km.

The level number 8 corresponds to a distance of 2976.289 km.

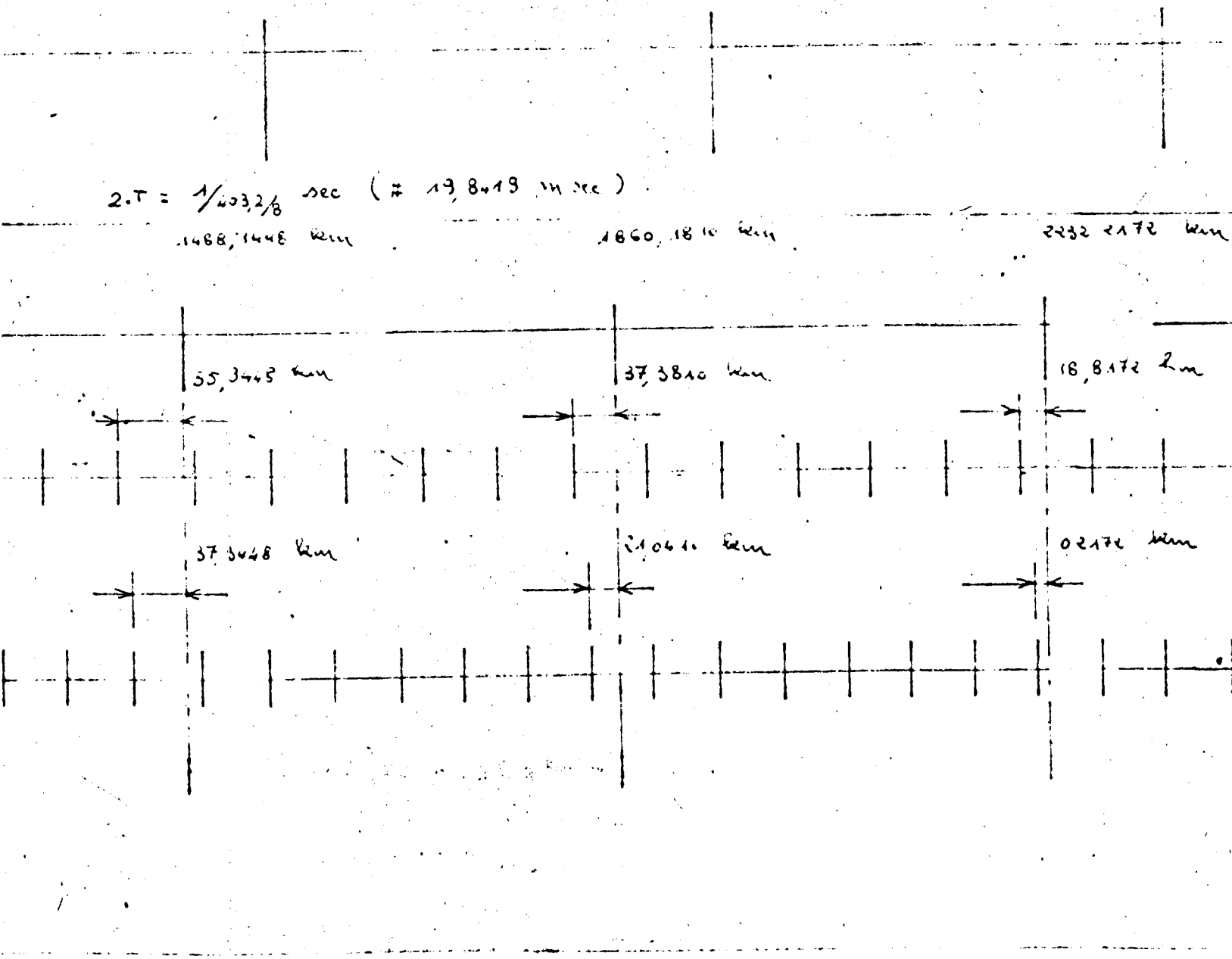

1 cm = 50 km
D_2 = 390,625 km
$2r_2 = 1/384$ sec
372,0362 km
D_3 = 372,0362 km
$2r_3 = 1/403,2$ sec
D_1 = 65,1 km
69,5362 km
37,236 km
D_2 = 558 km

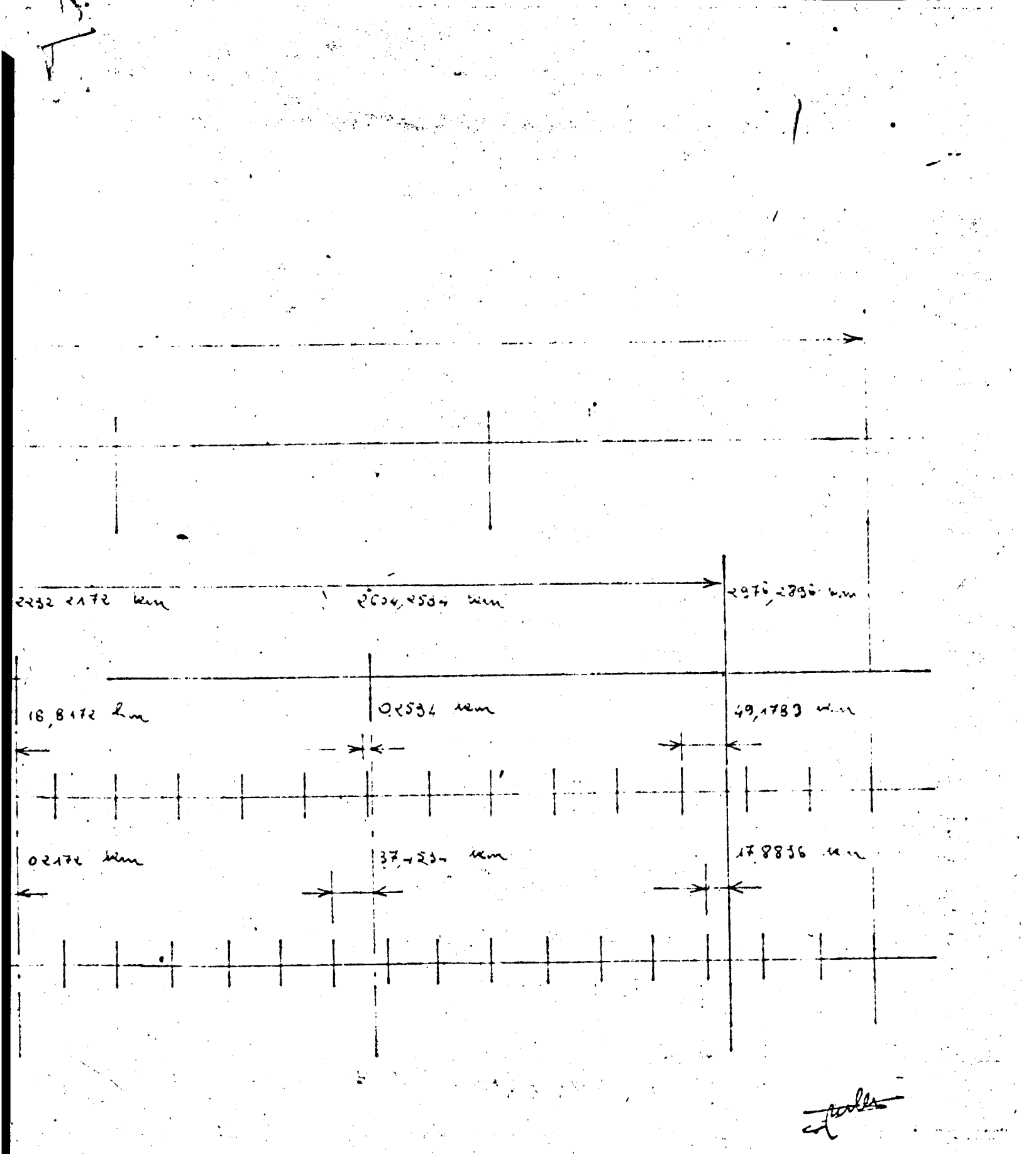
Simulation distance
DISTANCE SIMULATION

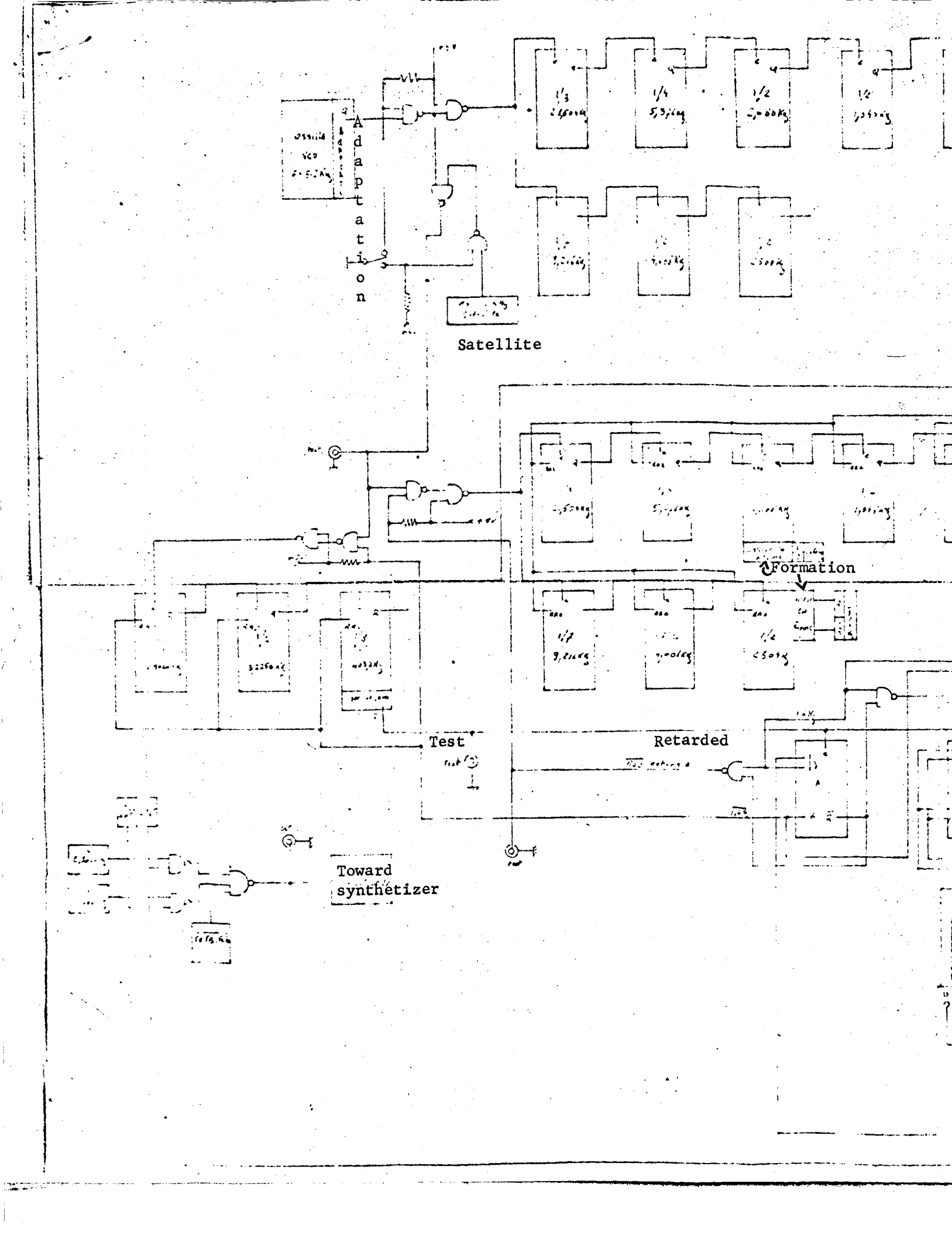
D = 3125 Km 2.T : 1/48 sec (≠ 20 833 m sec)

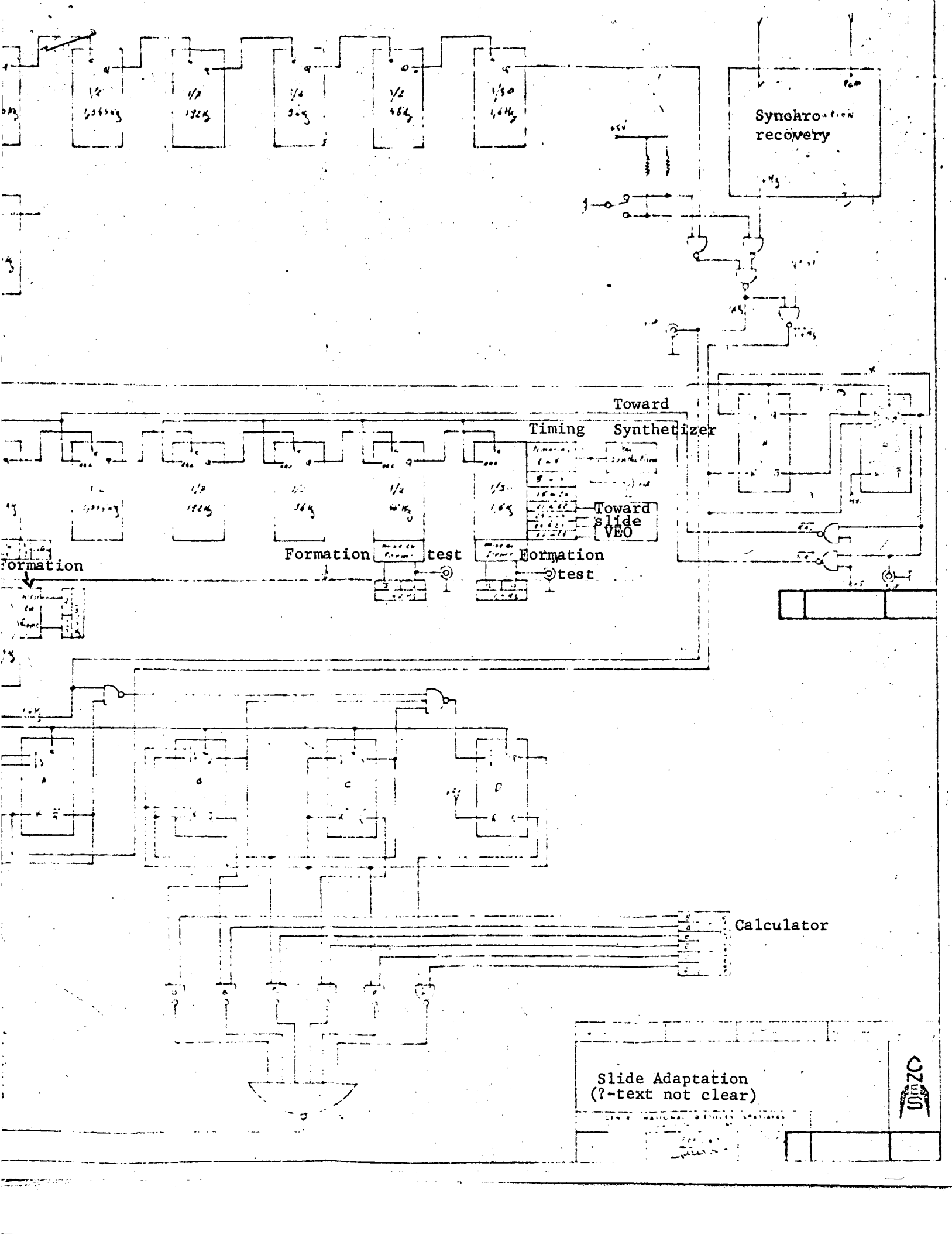


≠ 20,933 m sec) (= 1/384,8 sec)




2232 2172 km
2504,2504 km
2976,2896 km
18,8172 km
0,2594 km
49,1783 km
0,2172 km
37,7234 km
17,8836 km


Adaptation
Satellite
Formation
Test
Retarded
Toward
synthetizer


Synchro-
recovery
Toward
Timing
Synthetizer
Toward
slide
VEO
Formation
test
Formation
test
Formation
Calculator
Slide Adaptation
(?-text not clear)

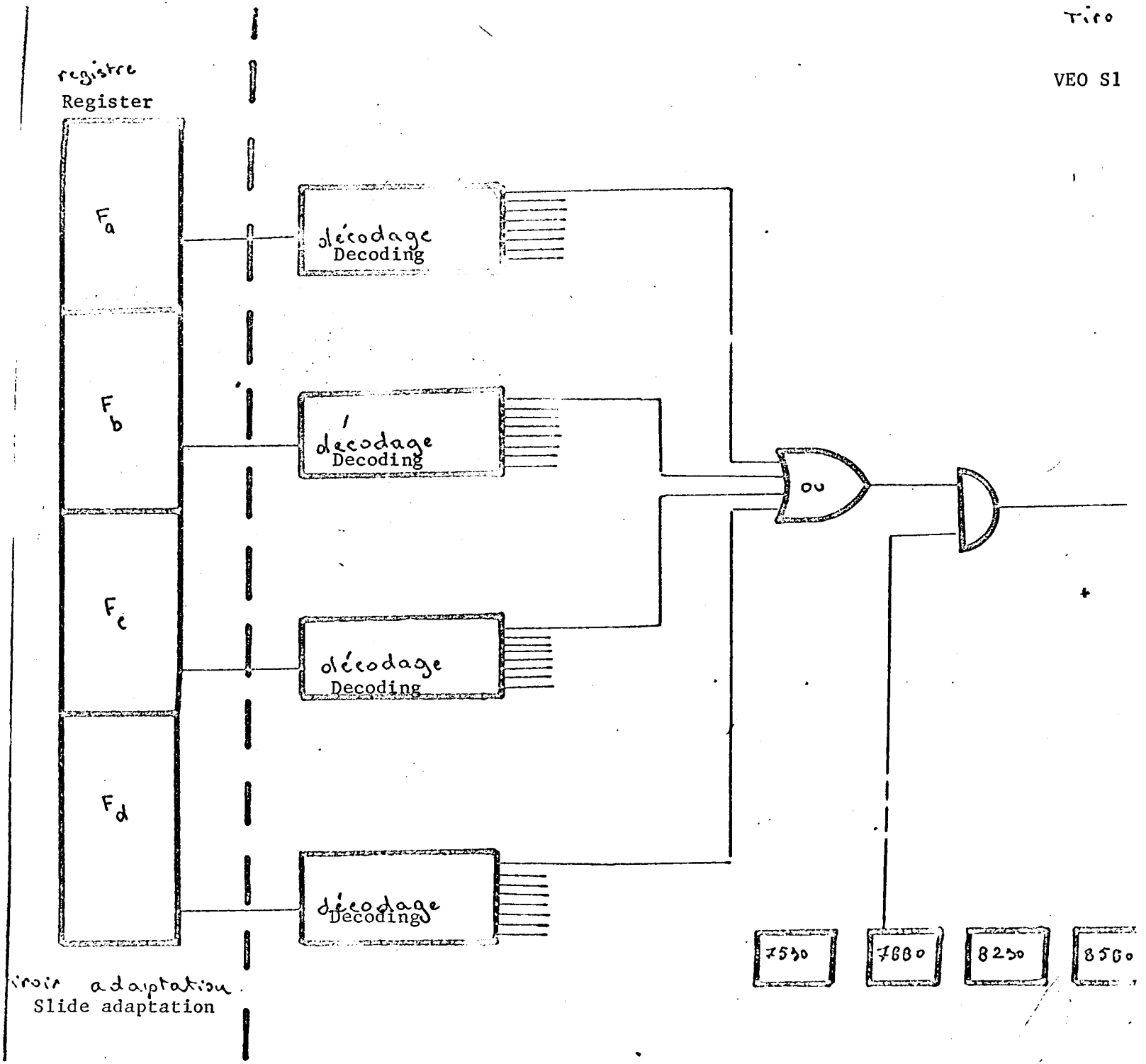
VEO SLIDE

VEO Slide

1. Generalities
2. Decoding of the levels
3. Oscillators
4. Mixer

Tiro

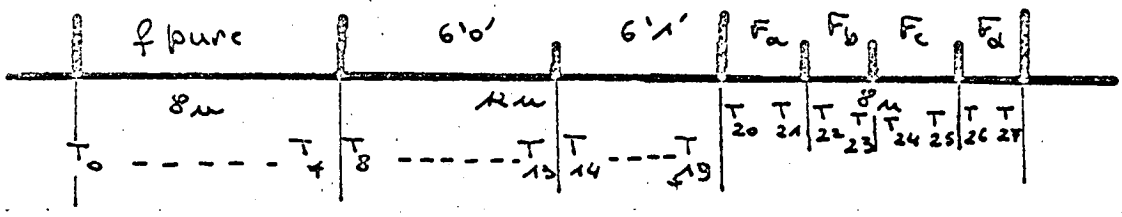
VEO S1


registre
Register
F_a
F_b
F_c
F_d
décodage
Decoding
décodage
Decoding
décodage
Decoding
décodage
Decoding
ou
7530
7680
8230
8560
Tiroir adaptation
Slide adaptation

1. Generalities

1.1 Calls

The balloon information contains four frequencies F_a, F_b, F_c, F_d which appear during 2 u (u = 1/48 sec) each.



The F_i frequencies (i = a, b, c, d) are contained between 7.5 k Hz and 10 k Hz; they can be all equal among themselves or different.

1.2 Principle of realization

The adaptation slide contains four registers (at three bits) corresponding to each frequency. Therefore we have the possibility of causing the frequency F_i to vary in eight levels and this between 7.5 k Hz and 10 k Hz.

Eight oscillators commuted in time to the determine timing will permit obtaining the eight desired frequencies and this for the information desired (F_i).

A mixer circuit will next lead to the VEO slide the generation of the $F_a+F_b+F_c+F_d$.

The VEO slide contains three essential parts:

1) Decoding

2) Oscillators

3) Mixer

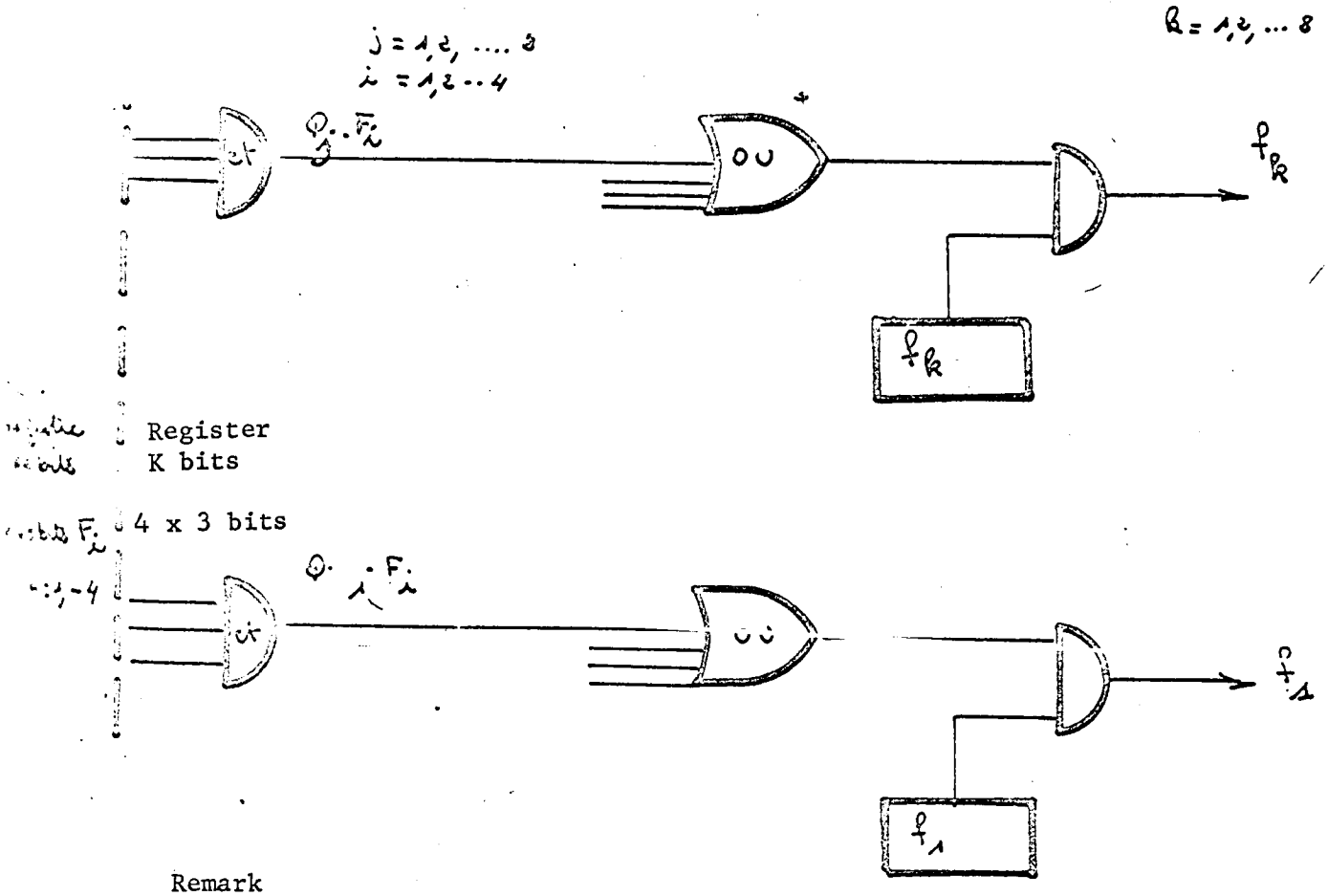
2. Decodings

2.1 Principle

The adaptation slide contains four registers corresponding to each of the F_i frequencies. (A slide weight, B, C great weight.)

With each register are associated eight decodings (8 levels). Each decoding attacks an "on" opening which validates the output of a frequency.

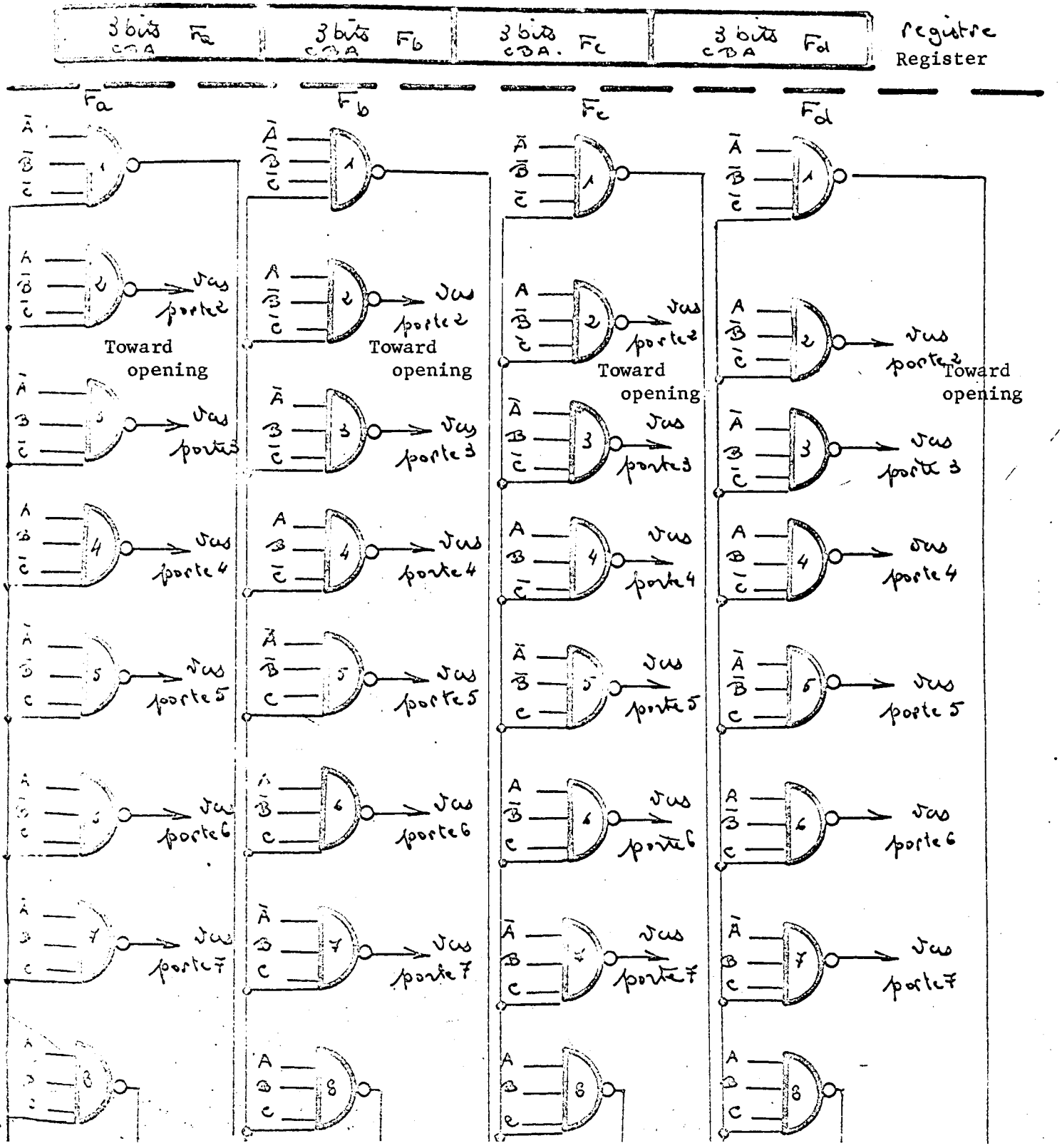
$(f_5 < f < 10\ kHz)$.



Remark

The F_i registers not being charged at the same time as the "on" circuit one has only a single input charge with information.

2.2 Realization



3. Oscillators

3.1 Call choices of the frequencies

The four F_i frequencies ought to be variable from 7.5 k Hz to 10 k Hz. Sweeping the region of frequencies with eight levels has been anticipated. The frequencies retained are indicated below.

$f_1 = 7530\ Hz$ (level number 1)

$f_2 = 7880\ Hz$

$f_3 = 8230\ Hz$

$f_4 = 8580\ Hz$

$f_5 = 8930\ Hz$

$f_6 = 9280\ Hz$

$f_7 = 9630\ Hz$

$f_8 = 9980\ Hz$ (level number 8)

Eight oscillators assure the generation of the eight frequencies.

Remark

The denomination of the slide generator of the F_i frequencies "VEO slide" is due to the utilization of a VEO mounting for the obtaining of the desired frequencies.

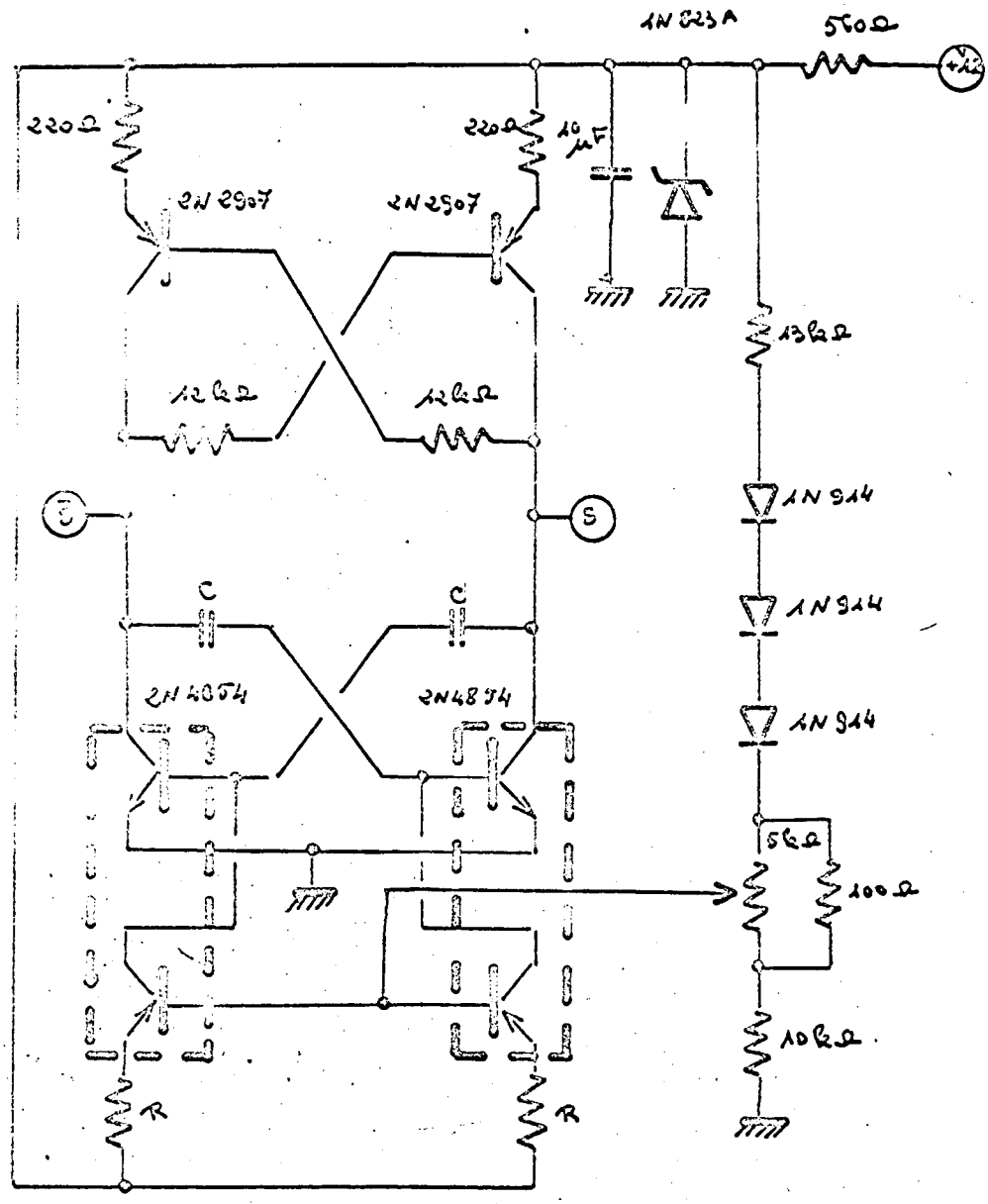
The command transistor of the system has been suppressed, the function $f_{Hz} = f(V_c)$ not having in this application any reason for existence.

3.1 again Frequency 645 K Hz

We have seen that we should use a frequency of 645 K Hz for the distance simulation.

This frequency will be obtained by an oscillator identical (last line lost on the bottom of page 6)

3.2 Schema of the oscillators



The regulation of the desired frequency is accomplished by the choice of R and C and by action on the petentiometer.

Remark

In order to obtain the eight desired frequencies we shall use eight oscillators of this type.

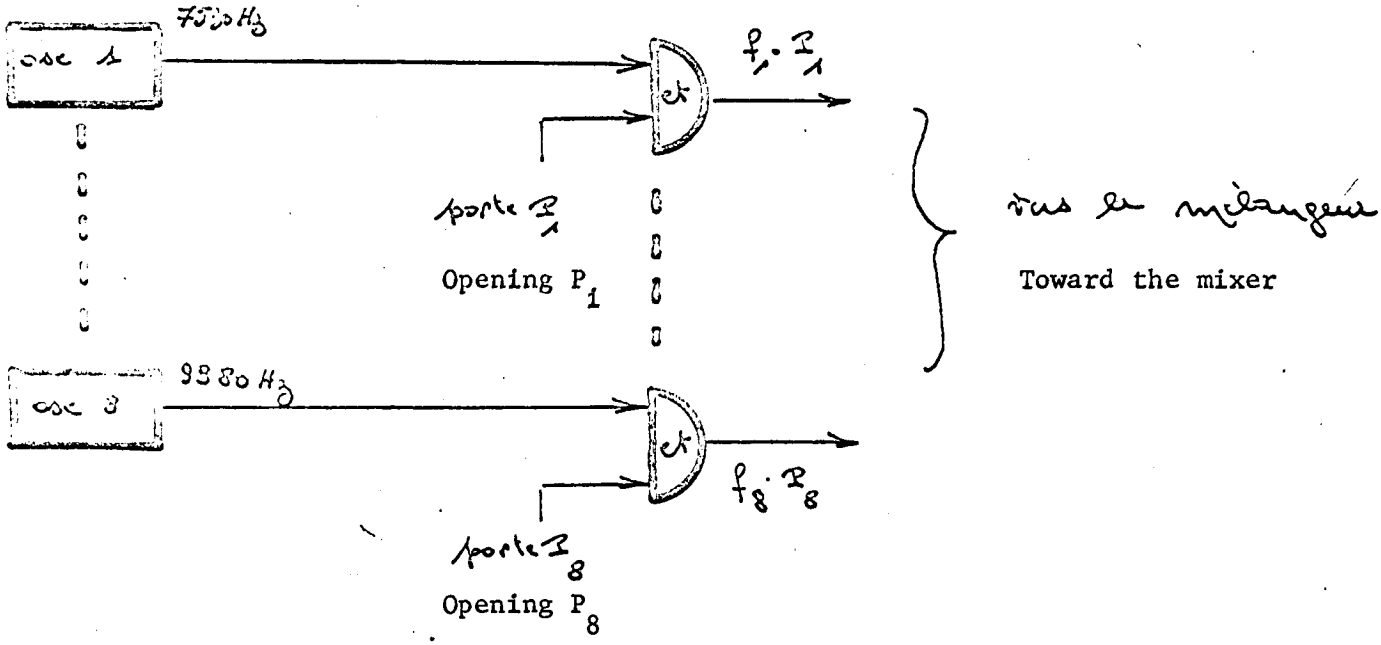
4. Mixer

4.1 Principle

The goal to be attained being the generation of the train of frequencies $F_a+F_b+F_c+F_d$ using eight fundamental frequencies, a double function remains to be realized: the validation and the mixing of the frequencies.

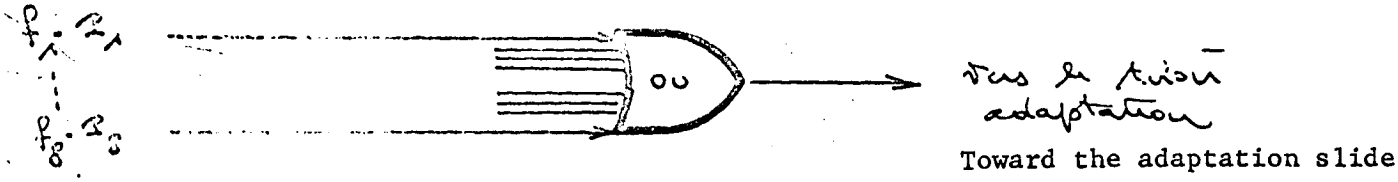
4.2 Validation: principle

The validation of the frequency is given by the output of one of the openings $(P_i....P_8)$.

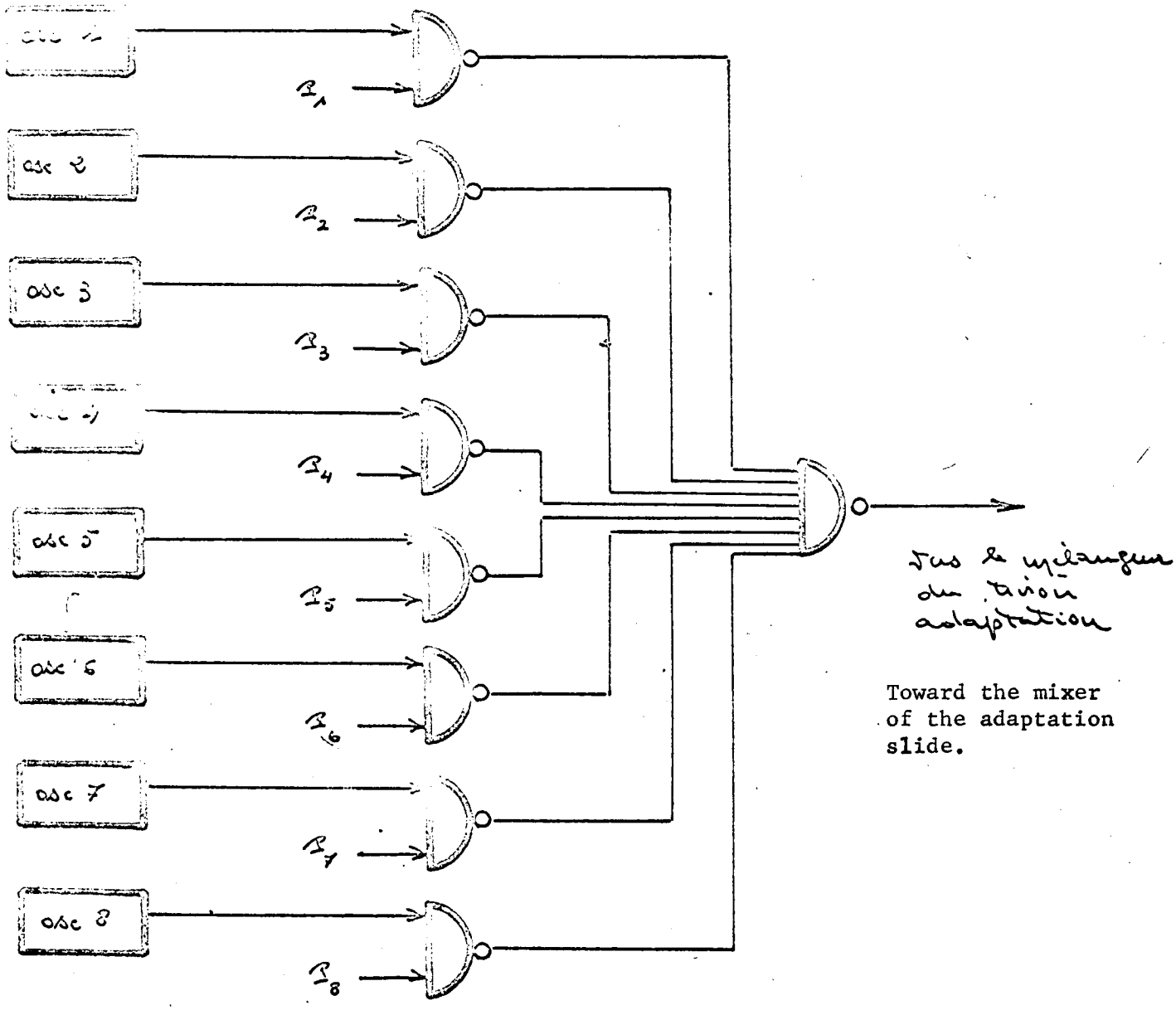


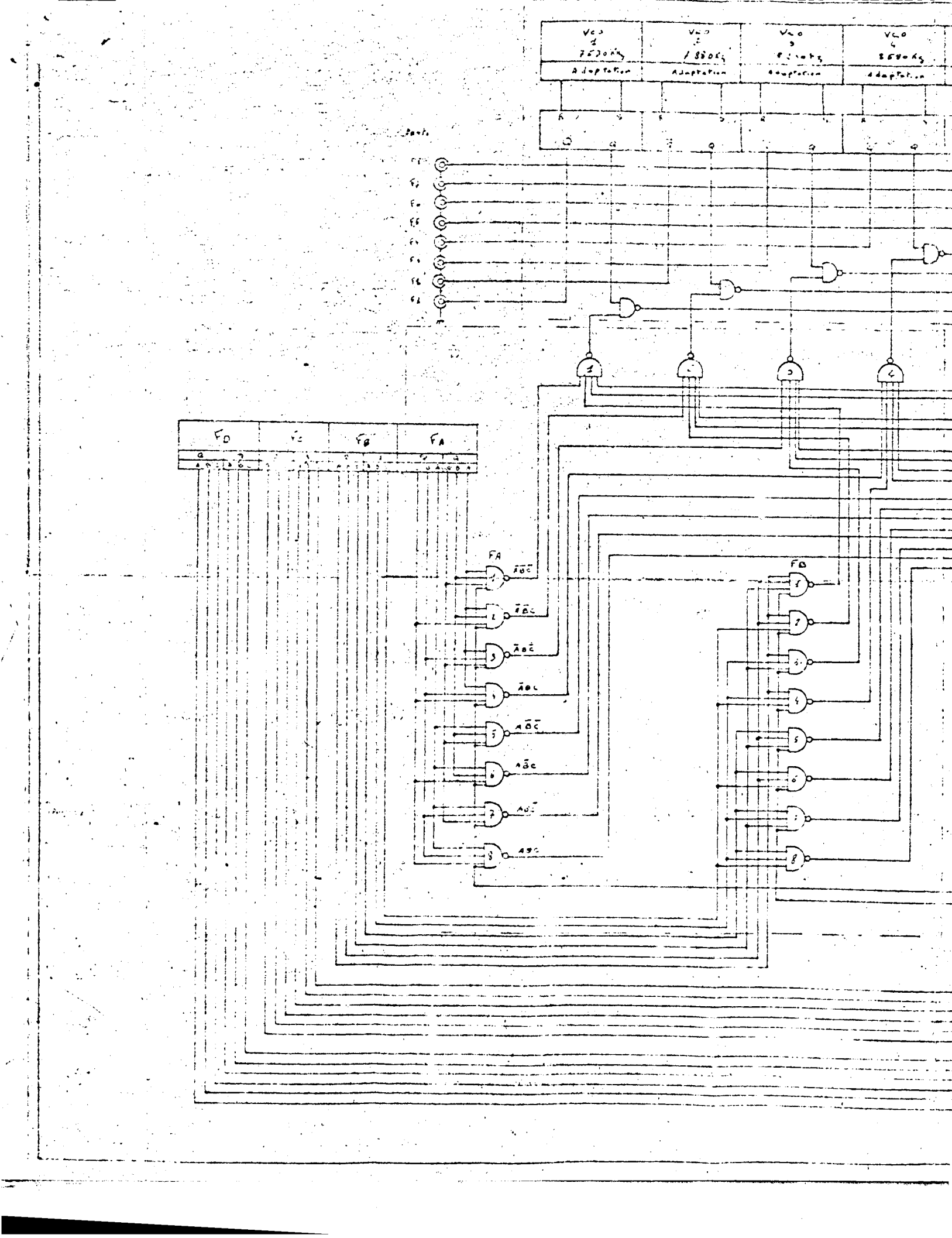
4.3 Mixer: principle

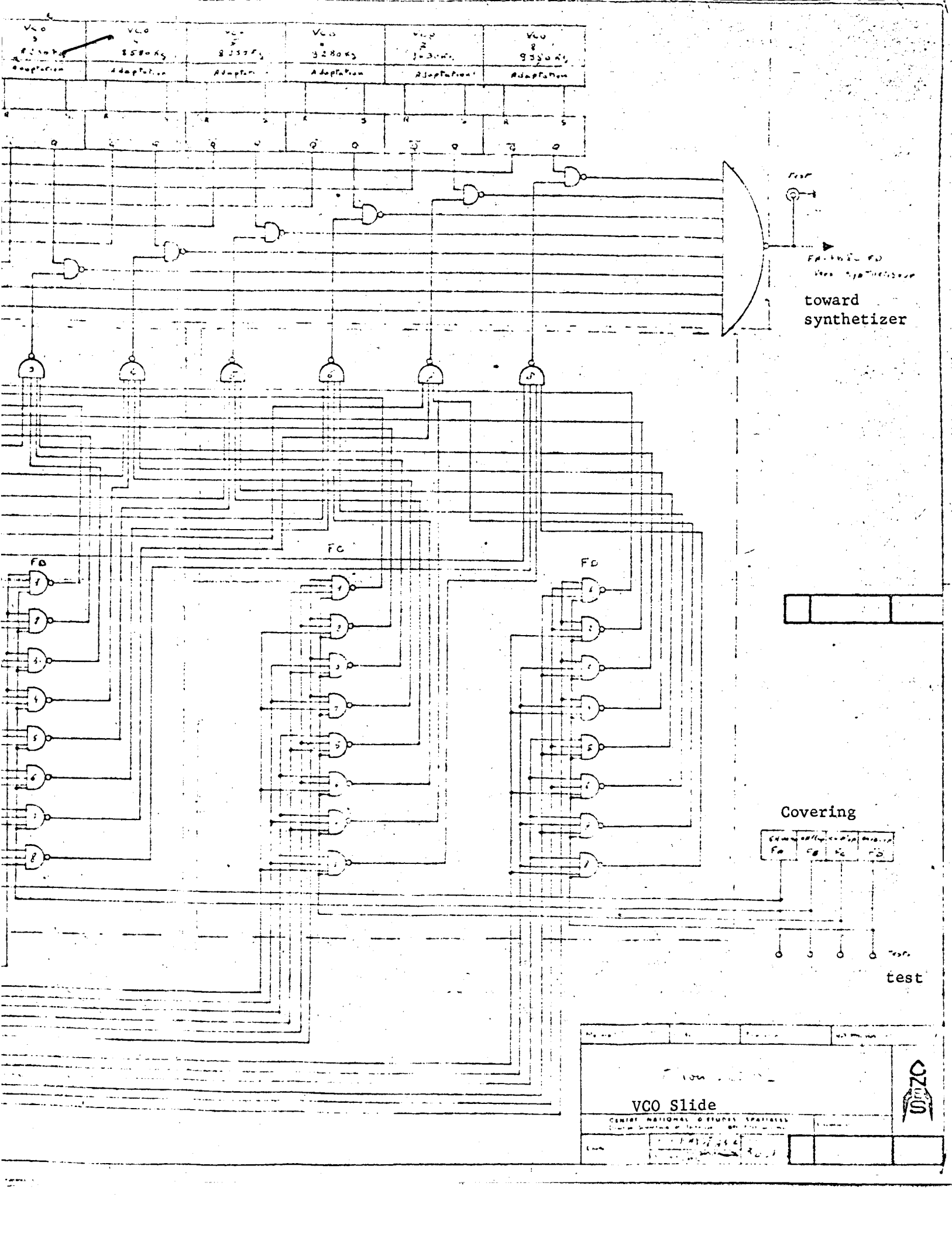
The eight outputs $F_i.P_1....F_8.P_8$ return to an "on" opening which assures mixing.



4.4 Realization




VCO 1
VCO 2
VCO 3
VCO 4
Adaptation
Adaptation
Adaptation
Adaptation
Bouton
F1
F2
F3
F4
F5
F6
F7
F8
1
2
3
4
FD
FC
FB
FA
FA
FD
ĀBC̄
ĀBC
ĀB̄C̄
ĀBC
AB̄C̄
AB̄C
ABC̄
ABC


toward
synthetizer
FC
FD
FD
Covering
test
VCO Slide

UHF BALLOON-SATELLITE CONNECTION

SYNTHETIZER ATTENUATOR

Synthetizer-Attenuator

1. Synthetizer

The machine used is a Hewlett Packard equipment model 5105A 0.1 Hz 500 M Hz. This material is associated with a "driver" model 5110B Hewlett Packard.

The whole permits obtaining a phase modulation and the direction of the Doppler of the central frequency.

The central frequency of utilization is 401.717960 M Hz.

2. Attenuator

The programmable attenuator utilized is a Schlumberger model BDD 500 odb to 140 db.

In the EOLE case this equipment is utilized in the region -15 db, -120 db in order to restore the conditions of the BL-SAT connection.

The decoding of the eight levels of three bits of distance simulation command permits covering the region with a variation step of 15 db.

first level - 15 db

second level - 30 db

---

eighth level - 120 db

Remark

The utilization of a programmable attenuator permits associating the energetic simulation to the distance simulation.